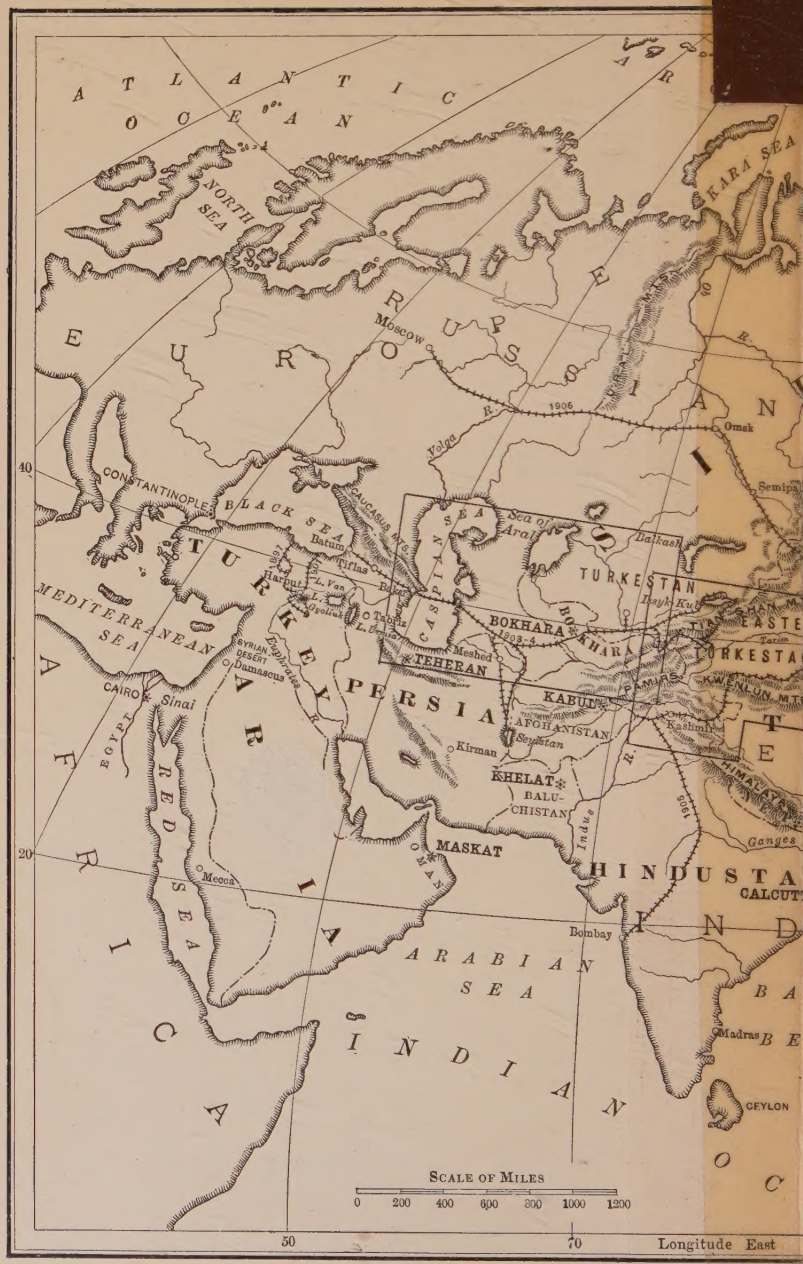
ATLANTIC OCEAN
NORTH SEA
KARA SEA
EUROPE
RUSSIA
Moscow
Volga R.
1905
Omsk
Semipa
CONSTANTINOPLE
BLACK SEA
CAUCASUS MTS.
CASPIAN SEA
Sea of Aral
Balkash
TURKESTAN
Issyk Kul
Batum
Tiflis
Baku
Harput
L. Van
L. Urmia
Tabriz
Meshed
TEHERAN
BOKHARA
1903-4
TURKESTAN
EASTE
Tarim
TURKEY
MEDITERRANEAN SEA
SYRIAN DESERT
Damascus
Euphrates R.
PERSIA
KABUL
PAMIRS
KWENLUN MTS
AFGHANISTAN
Seistan
Kashmir
CAIRO
Sinai
EGYPT
Kirman
KHELAT
BALUCHISTAN
Indus R.
HIMALAYA
Ganges
MASKAT
OMAN
HINDUSTA
CALCUTT
Mecca
RED SEA
AFRICA
ARABIA
Bombay
ARABIAN SEA
INDIAN OCEAN
Madras
CEYLON
SCALE OF MILES
0 200 400 600 800 1000 1200
40
20
50
70
Longitude East

NORTH AMERICA
BERING SEA
OKHOTSK SEA
JAPAN SEA
EMPIRE OF JAPAN
PACIFIC OCEAN
MONGOLIA
PEKIN
SEOUL
TOKYO
Shanghai
Canton
Hoangho
Yangtse
Lena R.
Salwen R.
STANOVOL MTS.
L. Baikal
SIAM
BANGKOK
CAMBODIA
FRENCH CHINA
ANAM
SOUTH CHINA SEA
MANILA
PHILIPPINE ISLANDS
MALAY PENINSULA
SUMATRA
BORNEO
from Greenwich
110
130
40
20

THE PULSE OF ASIA

H8

THE PULSE OF ASIA

A JOURNEY IN CENTRAL ASIA ILLUSTRATING THE GEOGRAPHIC BASIS OF HISTORY

BY

ELLSWORTH HUNTINGTON

BOSTON AND NEW YORK
HOUGHTON MIFFLIN COMPANY

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TO

WILLIAM MORRIS DAVIS

FIRST OF MODERN GEOGRAPHERS

26422

INTRODUCTION TO NEW EDITION

PULSATORY CLIMATIC CHANGES

THIS book is primarily the record of a journey of exploration in a remote and unique region — the heart of Asia. It is more than that, however, for scattered through the narrative there runs a description of the physical features of the great central basin of Asia and a discussion of their effect upon the life and habits of two contrasted types of people. One type lives in the mountains around the basin. It is nomadic and obtains its support chiefly from sheep, horses, and cattle, and its life is full of movement and excitement. The other type lives in the oases of the basin itself amid vast desert wastes of sand, gravel, clay, and salt. Its life is hemmed in by the narrow circle of the irrigated land and of the reedy poplar brakes roundabout, and so it is monotonous, unstimulating, and yet to the traveler most fascinating. Shot through the narrative and the description of the land and people there is yet another phase of this book. It takes the form of an attempt to state clearly and impartially the evidence which ultimately led to what I have called the hypothesis of pulsatory climatic changes. Among the mountains as well as in the deserts there are abundant indications that at some time the climate was different from now, the country more densely populated, and the civilization higher. Much of the narrative takes its color from the fact that my main object was to visit the ruins that lie far

out in the sand, or to study the shores of dried-up lakes where to-day no one travels save when the bitter cold of winter makes it possible to carry water in the form of cakes of ice that will not speedily evaporate.

So far as concerns the narrative, the descriptions, and the statement of the facts bearing on the climatic hypothesis, little comment is needed in this introduction to a new edition. I should like, indeed, to rewrite them more vividly and forcibly, but that hardly seems wise at present, for there is nothing of great importance that I wish to unsay. There is, however, much in addition that I would gladly say. The hypothesis of climatic changes and the idea of their relation to history and to human evolution has developed as I never dreamed would be possible. While the reader of this book will, I believe, gain wrong ideas in only minor particulars, his views will be incomplete and one-sided unless he knows what has happened during the twelve years since the book was first written. Therefore, for the sake of the scientific reader, I shall show how one after another of the ideas expressed in these pages has been amplified, improved, and in some cases set aside for something better. I shall follow the chronological method, and shall discuss only my own writings because they form a connected series and embody all that it has been possible to gather from other writers who have either criticized or upheld my original conclusions. It must be understood that many of the new viewpoints mentioned in succeeding paragraphs have been due to the comments of critics, and there is no doubt that further and perhaps still greater advances will thus be brought about during the next few years. Hence the reader must scan these pages

with the thought that he is watching a theory in process of construction, and that if he turns his eyes away for a bit he may come back to find that certain phases of it already wear a new aspect.

After *The Pulse of Asia* was finished in 1907 the next step was obviously to carry the investigation into new fields. Palestine was chosen, partly because that country is geographically unique, and partly because there and in the neighboring regions the course of history can be traced far into antiquity. As the result of a journey in 1909, under the auspices of Yale University, *Palestine and its Transformation* was published in 1911. The evidence discussed in that book shows that Palestine and Syria are full of proofs of climatic changes quite as convincing as those in Central Asia. Moreover, the indications of pulsations are even stronger than appears in *The Pulse of Asia.* The curve shown on page 349 of the present book indicates dry periods from four to six hundred years after Christ and possibly about 1200 A.D. The evidence from Palestine and Syria indicates a marked dry period not only at both of these times, but about 1200 B.C., while there are indications of minor periods at earlier times and also about 800, 600, and 100 B.C. and 300 to 400 A.D.

The complexity of the climatic curve on page 403 of *Palestine and its Transformation* caused some critics to feel as if pulsations were being piled up indefinitely and without due warrant. Moreover, certain historians deemed it wholly inadmissible that historical evidence as to migrations and famines should be used as proof of dry periods which were supposed to be the cause of those same migrations and

famines. The most notable case of this kind was the thirteenth century B.C. Future investigations, as will shortly appear, have confirmed this in a way that strongly upholds the value of the method. In *Palestine and its Transformation* a fuller attempt was made than in the present volume to interpret history in the light of climatic changes, but the matter was rendered difficult partly by the disagreement of historians as to the dates of many early events, partly by the difficulty of obtaining precise data as to the number and intensity of climatic changes, and partly by the absence of any definite standard by which the climate of the past might be measured for decade after decade.

The next step in the study of climatic changes was to transfer the field of effort from the Old World to the New. I cannot be too grateful to my good friend Dr. D. T. MacDougal, of the Desert Laboratory of the Carnegie Institution of Washington, for persuading me to do so. When he invited me to coöperate with him in Arizona I consented largely as a matter of conscience. I knew that having studied the climatic problem in Asia I ought to study it in similar parts of America. I supposed, however, that the absence of historic records, the relative scarcity and insignificance of ruins, and the smaller size of the American deserts would be such a handicap that no important results could be expected. It was a great surprise to find myself wrong in all these respects, as is fully set forth in *The Climatic Factor* (1914).

The chief forward steps represented by that book are briefly as follows: Innumerable ruins and many enclosed salt lakes present evidence almost exactly like that described

in the present volume. Many a time in the deserts of Arizona and New Mexico I reasoned just as in Central Asia. Looking at the map I concluded that there ought to be a ruin in approximately such a location even though none had been described, and in nine cases out of ten the ruin was there along some now dry water-course.

The study of ruins and of lakes in the United States, however, was unsatisfactory because of the impossibility of ascertaining exact dates. Something else was needed, and most fortunately it was supplied by another good friend, Dr. A. E. Douglas, of the University of Arizona. Before I made his acquaintance he conceived the brilliant idea of measuring the climate of the past by means of the thickness of the annual rings of growth in trees. At his hands this method has reached such a pitch of perfection that he can identify the date of a given ring with an error of only a small fraction of one per cent. Following his lead and with the assistance of the Carnegie Institution, I was able to measure the rings of about 450 giant sequoias, or redwoods, among the Sierra Nevada Mountains. These measurements, when properly corrected, give a climatic curve extending back more than three thousand years. This curve is highly important because it forms, as it were, the only definite yardstick by which to measure the climate of historic times. With the final corrections, which Dr. Douglas has now perfected, it will ultimately be possible to determine from this curve the approximate climatic conditions of any part of the world at any time during the last three thousand years. This is because the whole trend of modern climatic studies is to show that a given change in one part of the

world is correlated with definite and predictable changes in other parts.

For our present purpose the most significant feature of the California tree curve is that its main features agree with those inferred in Asia. To be sure, it adds many minor fluctuations of which no inkling had been gained in the Old World, but each marked change that had been definitely determined in Asia is also strongly marked in California, for the two regions lie in the same climatic zone. The dry period in the thirteenth century B.C. is particularly prominent. Two other facts about the tree curve deserve notice. The first is that the modern growth of the trees shows a pronounced correlation with modern records of rainfall in Italy and Palestine, so that we are warranted in using the curve as a record of the climate in those regions as well as in America. The second is that Dr. Antevs, of Stockholm, who has made a most exhaustive study of all that has been written on tree-growth as a measure of climate, believes that in correcting the California curves I have gone too far in smoothing out irregularities during the earlier centuries. Thus, the trees, in conjunction with the ruins and lakes, and aided by historic records of famines and migrations, seem to furnish unassailable evidence that climatic pulsations of considerable magnitude have actually taken place at corresponding times in the Old World and the New.

Still another new line of evidence is described in *The Climatic Factor*. After studying the desert ruins of the United States I turned to tropical countries, and examined the wonderful ruins in Oaxaca in southern Mexico, and the still more remarkable Maya ruins in Yucatan and Guatemala.

Many of these are located in regions where the heavy rainfall and dense vegetation, aided by malarial fevers, now render agriculture and civilization impossible. The only satisfactory explanation of the facts seems to be that when the ruins were built the climate was drier and more bracing than at present, so that agriculture was easier and diseases less prevalent. An examination of the history of the Mayas shows that they rose to power at times when the deserts farther north became moist. In other words, dry conditions on the borders of the tropics seem to occur contemporaneously with moist conditions in the deserts. Soon after I reached this conclusion the German geologist, Penck, who is recognized everywhere as one of the chief authorities on the glacial period, announced that on grounds quite different from mine he, too, had reached the conclusion that when some zones become rainy, others become dry. Moreover, many students of present climatic conditions have recently shown that exactly opposite changes of temperature or of rainfall take place in different parts of the earth, and that the chief centers of changes of one type or the other are well defined.

What has just been said indicates a great change from the assumption of this book that similar climatic variations take place synchronously all over the world. That mistaken assumption was not based on my own work, but on the generally accepted but now fast vanishing ideas of geologists as to the uniform cooling of the earth during glacial periods. Another such change of opinion is set forth in a paper entitled "The Solar Hypothesis of Climatic Changes," published in 1914 in the *Bulletin* of the Geological Society of

America. This was intended partly as an answer to various critics of *The Pulse of Asia.* To one of those critics, Professor J. W. Gregory, I am especially indebted for compelling me to reëxamine the question of temperature in relation to climatic changes. This led to the conclusion that there is no good evidence of any appreciable change in mean temperature during the last three thousand years. At most the change amounts to only two or three degrees and perhaps less. There seems, however, to be abundant evidence that the paths and intensity of storms, as well as their frequency, are subject to constant changes. This apparently is the cause of most of the climatic pulsations with which we have to deal in this book. If this is so, the probability that climatic changes are largely due to solar changes is greatly increased, for as Kullmer and others have clearly shown, storms are most intimately connected with variations in the activity of the sun's atmosphere. Although the matter is still subject to fierce debate, it seems possible that these variations in the intensity and course of storms are largely due to variations in the sun's magnetic or electrical activity. The reasons for this are given in a series of papers entitled "Solar Changes and Terrestrial Weather," which appeared in the *Monthly Weather Review*, 1918. Perhaps one of the next great subjects of study may be the effect of electrical variations upon man's own activity. It is well known that electricity is a great stimulant, but whether the little electrical variations occurring naturally in the air are important in this respect no one yet knows.

To Dr. Kullmer I am indebted not only for his illuminating work on the relation of the sun to storms, but for a sug-

gestion which crystallized in my own mind a plan that I had long been considering. He suggested that there appears to be a most remarkable connection between storms and civilization. Where storms are frequent, civilization is high, and where they are lacking, it is low. This idea led me to undertake an extensive investigation in order to determine exactly what effects are produced upon the human body by different kinds of weather. The result was a volume entitled *Civilization and Climate* (1915), which seems to supply a new clue to the relation of climatic pulsations to history. When the present book was written, and for some years thereafter, I supposed that by far the chief effect of variations in climate was the increase or diminution of the food supply. Then in studying Central America and Greece it became evident that diseases like malaria must be carefully considered. Not until *Civilization and Climate* was being written, however, did it become clear that the direct effect of climatic conditions upon man's energy and will power, as well as upon his health, is of the most vital importance. In that volume it appears that factory operatives do their best work with a mean temperature a little above 60° F., while students seem to work most profitably when the average outside temperature is not much above 40°. Moreover, both operatives and students work fastest on days when the thermometer falls somewhat. These facts and others made it possible to construct a map of climatic energy. That map agrees to a remarkable extent with a map of civilization based on the opinions of about fifty experts from fifteen diverse countries. Moreover, when allowance is made for the climatic pulsations which are the thread of our whole prob-

lem, it appears that not only now but throughout history, civilization has risen to high levels only in regions blessed with a stimulating climate marked by frequent changes of temperature. While high temperature and low are both harmful to human activity, a few months of either appear to be much less harmful than uniformity. Hence storms or other agencies, such as winds, which bring variety, are one of the prime factors in enabling a people to preserve the vigor and determination essential to an advancing civilization.

This study of the effect of temperature and of variability made it possible to apply our climatic hypothesis to history on a broad scale, as has been done in the last chapter of *Civilization and Climate*. As soon as that book was finished, however, further study of the optimum or most favorable conditions of climate was evidently necessary, together with an investigation of the differences between races in their relation to climate. Such a study is described in *World Power and Evolution* (1919). There nine million deaths in the United States, France, and Italy are minutely analyzed in their relation to temperature and humidity. About fifty million more are studied less thoroughly, but with sufficient detail to show that they agree with the nine million. From this vast body of data pertaining to nearly a score of countries certain great conclusions stand out. The health of the human race is best when the temperature averages about 64° for night and day together, and when the relative humidity averages about 80 per cent. This is almost the same for all races, whether they be the Finns of the north or the Sicilians of the south. Even the negroes appear to be at

their best when the average temperature is not over 68°. Constant changes, however, are needed. A study of the daily deaths in New York City for eight years shows that at all seasons, summer and winter alike, a drop in temperature is beneficial, while a rise causes weakness. Continued low temperature, indeed, is harmful, but the *change* from high to low is valuable. Moreover, a study of the variability of the weather for these same years shows that the stimulus derived from a fall of temperature more than overbalances the inertia resulting from a rise. To this must be added the fact that the greatest mental activity appears to occur when the average outside temperature is about 40°. Thus the climate that the world most needs is one where the summer average is about 64°, and the winter average about 40°, and where a constant succession of storms brings frequent alternations of cold and heat, moisture and dryness, cloud and sun.

Looking back now to our solar studies, we find that when the sun's atmosphere is active, stormy and variable weather tends to occur in certain well-defined belts which apparently vary in location according to the intensity of the solar activity. One of these belts lies well to the north and influences the northern United States, southern Canada, southern Greenland, Iceland, and northwestern Europe. The other belt traverses Arizona, the Gulf of Mexico, the Mediterranean region, Persia, and other parts of Central Asia as well as northern India. Let us briefly review what happened in these places near the beginning of the fourteenth century of our era. As to the northern United States and Canada we have no knowledge, but the sequoia trees of California grew

phenomenally fast, and the Maya civilization of Yucatan apparently made its last great spurt. In northwestern Europe there is abundant evidence of great storminess with consequent poor crops and other disasters in England and Scandinavia, and floods and droughts in France and Germany. At that same time Italy showed extraordinary activity in the advancement of civilization, for there the storminess was not so great as to bring disaster, but apparently served as a stimulant both to man and to agriculture. Far away in Central Asia the Caspian Sea and Lop-Nor expanded as explained in this book. Moreover, at about that time the sun's surface seems to have been unusually active, although of course the data are extremely scanty. The outstanding fact is that the fourteenth century furnishes an example of all the phenomena which would be expected to accompany a period of intense storms. In earlier periods, such as the time of Christ and especially the fifth and fourth centuries B.C., the same thing seems to have been even more true. Thus scattered here and there through the course of history periods of climatic extremes appear to be associated with corresponding periods of human extremes.

Still another apparent effect of climatic changes remains to be considered. The evidence of geology and paleontology shows that life of all kinds has tended to evolve with great rapidity during times of climatic stress. Such times appear to have been like the more stormy historic periods except that they were more severe. They were marked by wholesale destruction of old species, genera, and families. Still more important is the fact that they were also marked by the sudden rise of many new forms of life. Modern ex-

periments are beginning to indicate that cooling and to a less degree heating of the eggs or young during a short critical period tend to cause mutations whereby the offspring differ from any of the normal forms of their species. Such mutants are a possible source of new species. Among mankind some of them are the world's great minds. Thus we are confronted by the suggestion, which is as yet no more than a suggestion, that at times of climatic instability and storminess, or in places where great storminess and frequent changes of temperature abound, the human race is more likely to produce extreme types than under less variable conditions. Hence we should look for a great display of intellect during such periods.

Now at last we are ready for an attempt which was made in the last chapter of this volume twelve years ago, but which was largely a failure. I mean the attempt to see how the course of history has responded to climatic changes. All the factors have by no means been weighed as yet, nor do we know exactly how to go about the matter. We are merely ready for the first real experiment. This has been made in *World Power and Evolution*. Two trials are made. The first concerns the United States during the period from 1870 to 1910. Strange as it may seem, the general health of the country appears to vary greatly from year to year on account of climatic conditions, and this seems to have a marked effect on the course of business. When good health prevails, men are apparently optimistic and ready to engage in new enterprises. When bad health prevails widely, so that many people suffer from colds, indigestion, headaches, and other minor ailments as well as from the major diseases

which cause death, a feeling of conservatism comes over the community and business is injured. If this conservatism be intensified by bad crops, which are often due to the same climatic conditions which cause poor health, the country suffers seriously. It is impossible here to tell the whole story, and I must confess that thus briefly told it sounds improbable. Nevertheless, the facts seem strongly to suggest that the course of business in the United States is profoundly influenced by conditions of health, and that, except during great epidemics like that of 1918, the general health of the community depends largely upon the weather.

The second attempt to correlate history and climatic changes takes us back to Rome from the days of the early Republic to the time of Christ. There we use the curve of the California trees as our line of reference. When the trees grew fast we assume that storms were abundant just as they have been during the years since records have been kept. When storms were abundant there were frequent stimulating cold waves which kept the Romans in good health and thus helped to give them vigor and will power. At the same time the crops were better than now and there was much less danger of poverty and famine. Moreover, malaria, which has been one of the scourges of the country during all its later history, was comparatively rare and did little harm, as we know from actual records, and as we should infer from the climatic conditions. Finally, although it seems almost incredible, the variable climate may possibly have helped to cause great variability among the people, thus giving rise to an unusual number of minds above the average. When we trace the history of Rome step by step

for five centuries there appears an extraordinary agreement between human affairs and the conditions of climate. I realize that the whole subject is still in its infancy, and many of the ideas here advanced will need drastic revision. Yet the correspondence between human and climatic events is too close and too striking to be wholly set aside.

The Pulse of Asia ends with these words: "With every throb of the climatic pulse which we have felt in Central Asia, the center of civilization has moved this way or that. Each throb has sent pain and decay to the lands whose day was done, life and vigor to those whose day was yet to be." Sometimes, during the twelve years since these words were printed, I have wished that I had not written them. They certainly were not proved at that time. Now, however, I deliberately repeat them. I am not so positive about them as I was then, but I am confident that they at least contain a germ of truth.

E. H.

WASHINGTON, May, 1919

PREFACE

THIS book is the record of a journey in Central Asia, and its aim is to illustrate the geographic relation between physical environment and man, and between changes of climate and history. Most of the individual hypotheses advanced are already familiar, although the facts presented in support of them are new. If the book possesses any claim to recognition, it lies in the combination of various hypotheses, hitherto unrelated, into a single consistent geographic theory of history. The theory harmonizes a vast array of facts derived, not from one branch of science, but from the varied fields of geography, meteorology, archæology, folk-lore, and history. It will doubtless require modification, but if it shall advance the scientific as opposed to the empirical study of geography and history, the purpose of this volume will have been accomplished.

In the following pages, the name of Professor Davis, to whom the book is dedicated, appears frequently. He has raised geography from an empirical to a rational science. To him half the geographers of America, myself among the number, owe their instruction in the new science which, when it comes to its own, bids fair to be the most fascinating of all. I owe him far more than this, however, for it was through him that I had the opportunity to spend three years in Central Asia in addition to the four which I had previously spent in Asia Minor. Since my return to America, the liberal terms of a Hooper Fellowship in the Graduate School of

Arts and Sciences of Harvard University have enabled me to devote an uninterrupted year to the preparation of this volume and of several technical papers. During six years of intimate association with Professor Davis, I have ever found him the most inspiring of teachers, the most thoughtful of fellow travelers, and the most severe and helpful of critics. He has read the manuscript of this volume, and has suggested important modifications. The many faults of the book are mine; to him is due a large share of whatever in it may be valuable. I cannot here give adequate expression to my deep appreciation of all his help and kindness.

Two other friends have read the manuscript — Mrs. Charles L. Ziegler and Mr. Herbert R. Gibbs. Both have made most valuable suggestions, especially as to matters of literary form, where the scientist is apt to be weakest; and to both I render hearty thanks. My indebtedness to Mr. Robert L. Barrett, whose companion I was during the first part of the journey here described, is great, as appears in the Introduction. In India we were treated with the utmost courtesy by the government through Lord Curzon, to whom we would express our gratitude. The American traveler expects kindness from his English cousins, and is never disappointed. It is less common to be treated with unfailing courtesy and consideration by Chinese officials. It is therefore with peculiar pleasure that I put on record my thanks to the Chinese government for its genuine and ready help at all stages of my journey in China. In Russia and Siberia, through which lay my hasty homeward way, similar official courtesy was shown. The best was placed at my disposal; and although it was the midst of the revolutionary crisis,

my passport was not once asked for until I was about to cross into Germany at Warsaw.

In conclusion, I wish to make special mention of the kindness of George Macartney, Esq., British Political Agent at Kashgar in Chinese Turkestan. Though personally unacquainted with Mr. Barrett and myself, he took charge of our mail, procured currency for us, and sent men to us, bringing our letters and purchases. To the stay-at-home these things sound small, but when a man's mail and money reach him once in three or four months, after being carried five or six hundred miles by a special messenger on horseback or afoot, he feels extremely grateful to the man at the other end who sees that things go straight. One of the greatest pleasures in looking back at a journey in unknown lands is the memory of the chain of kindly deeds performed by missionary, consul, official, traveler, or native.

E. H.

Milton, Mass., July, 1907.

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THIS list comprises the books and articles to which specific reference is made in the following pages, and also a few not so referred to, but important. Other books have been read in the preparation of this volume, but need not be mentioned here. I have included my own articles, because they elaborate more fully the subjects treated of in this volume.

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THE PULSE OF ASIA

INTRODUCTION

THE SIGNIFICANCE OF CENTRAL ASIA

IN the progress of human knowledge the marked advances in each science have been made under the stimulus of a great fundamental principle. Astronomy could proceed but little beyond astrology until Newton discovered the law of gravitation; physics remained empirical until the conservation of energy was recognized; chemistry was merely alchemy until its pioneers worked out the unfailing law of the replacement of atom by atom; and geology would still be miner's lore, if scientists had not seen that in the course of ages the earth as we know it has been slowly evolved by processes identical with those still in action. So, too, in the biological sciences, botany, zoölogy, and physiology, all was confusion until Darwin touched the key of evolution and a vast number of apparently unrelated facts fell into their appointed places, and the way was open for the wonderful advances of the last half century.

The anthropological sciences are also bound together by the unifying principle of evolution. Geography, anthropology, history, and sociology form an anthropological group possessing a unity as great as that of the biological sciences, although this has been perceived only within a few years. The average man thinks of geography, the oldest of all the sciences, as a schoolboy study of maps and of empirical descriptions of places and people. He forgets that

the leaders of geographic thought have gone far beyond this, and are beginning to see that their science deals not only with the *distribution* of organic and inorganic forms in space, but also with the *relation*, both direct and indirect, of the entire group of organic forms inhabiting any part of the earth's surface to the inorganic forms in the same region. Geography, according to the new view, tells us not only what forms of plants and animals live together in mutual dependence, but also why the human inhabitants of a given region possess certain habits, occupations, and mental and moral characteristics, and why they have adopted a certain form of social organization. Among primitive people the relation of inorganic causes to organic results is universally recognized. Literature is full of references to the nearness of the Red Man to Nature, and to the complete dependence of primeval man upon her. Among highly civilized people, the relation is lost sight of because of the mixture of races, the growing control which man exercises over nature, and the rise of great religious or ethical ideas, racial hatreds, and dominant personalities. Nevertheless, it is there, and a patient untangling of the snarled threads of history will bring it to light.

In searching out the foundations upon which to build the new sciences of anthropology and sociology, students are turning more and more to geography in its broader sense. The anthropologist finds that the development of civilized man from the savage state is inextricably bound up with the various types of physical environment in which successive generations have lived. The sociologist discovers that the conditions of human society to-day are

in part the result of racial characteristics due to past environments, and in part the result of present geographic conditions. Climate, the relation of land and sea, the presence of mountains, the location of trade routes, and the suitability of a region for agriculture, mining, or manufacturing are all potent factors in determining sociological conditions. The dependence of history upon geography is equally great. In recent years there has arisen the so-called "bread and butter school" of historians, who hold that the deepest cause of historical events is the necessity of mankind to subsist. The ambition of kings, the hatred of race for race, the antagonisms of religion, may agitate the surface and cause the waves which seem to us so portentous; but far down below all these there is the unending struggle for bread. It is this primarily which makes men work. It manifests itself in the discontent of the poor peasants of Russia, in the disputes between labor and capital in America, and in the bitter cry of the famine-stricken millions of India and China against the foreigners who seem to rob them of bread. An increasing supply of food has made Egypt contented and prosperous during the last few decades. Scarcity of food, present or prospective, for its increasing population has brought Japan into conflict with Russia, and is bringing it face to face with the United States in California, where the Japanese coolie is said to take the bread from the mouth of the native-born American laborer. According to this view, geography is clearly the basis of history, for the productivity of a country depends upon geographic facts, especially upon climate.

In saying that geography is the basis of the anthro-

pological sciences, it is not meant to imply that physical processes explain all the qualities of man. They do not explain life, or mind, or ideals. At present we can only confess that we do not understand what these are, or how we came to possess them. We can only ascribe their origin to the same great Intelligence which framed the material universe and gave it immutable laws. We know, however, that they are the greatest forces in the world, the motive power which moves mankind. In the past, men have supposed that the human race either progressed blindly, or was led onward by the direct interposition of some unseen divine power. Now, we begin to see that man's course has been guided by his physical surroundings, just as a railroad winds here and there at the command of river, hill, or lake. To carry the analogy farther, the living mind of man, with its ideals, its love, and its pain, is the motive force to which is due the progress of human institutions; and history is the track along which man has advanced. Sometimes his course has been straight, sometimes devious, and at times it has doubled back on itself; but on the whole, it has led toward a dimly seen goal of uprightness, freedom, justice, and love.

We have studied the energizing mind, and know something of how it acts, though not of what it is. We have examined the human institutions of the home, the church, the state, and the social organization of industry; and our knowledge of them is large. The track, too, has been scrutinized minutely by historians; and we know its curves and grades, both up and down. One thing alone has been neglected: we have not looked at the country through

which we have passed. To-day we are beginning to study our surroundings, and to see that we have reached our present position because of certain geographic facts. Historians have been slow to accept this view. When they found a piece of downgrade in the track, they looked at the cars and the engine to find its cause. They have failed to see that the swift descent of the United States into a financial panic and the hard pull out of it may be due to the fact that the train is crossing a valley, and not to overloading of the cars in the shape of over-production, or to poor couplings in the shape of a weak financial system, though these may precipitate disaster. It may be, as we shall see, that panics are due to the regular recurrence of periods of deficient rainfall, causing poor crops and fluctuating prices. If this is so, we must not only look to our couplings and our load; we must bridge the next valley, or cut and fill the road-bed so as to diminish the grades.

Again, as we look at the past, we see the track of history double far back on itself at the time of the fall of Rome before barbarian invaders. At present we are facing a similar, albeit peaceful invasion on the part of the starving millions of China: the fear that our track may again turn back is before us. The relapse of Europe in the Dark Ages, as future chapters will show, was due apparently to a rapid change of climate in Asia and probably all over the world, — a change which caused vast areas which were habitable at the time of Christ to become uninhabitable a few centuries later. The barbarian inhabitants were obliged to migrate, and their migrations were the dominant fact in the history of the known world for centuries. We of to-day

shall do well to ascertain whether we too are not facing the problem which faced the Romans. Parts of China have been growing drier and less habitable during recent centuries, and if the process continues, we are in danger of being overrun by hungry Chinese in search of bread. We cannot, perhaps, prevent their migration; but if we understand the cause, we can profit by the lessons of the past and avoid the danger, as a railroad engineer avoids turning back by choosing a place where he can tunnel through the mountains to the broad uplands on the other side.

The importance of climate and of changes of climate in history and the allied sciences has never been fully realized. It is climate which causes the Eskimo to differ so widely from the East Indian; it is climate which almost irresistibly tempts the Arab to be a plunderer as well as a nomad, and allows the Italian to be an easy-going tiller of the soil. And, if Percival Lowell is right, it is the dry climate of Mars which has caused the inhabitants of that planet to adopt an advanced form of social organization, where war is unknown, and each man must be keenly conscious of the interdependence of himself and the universal state.

Four years of life in Asiatic Turkey and three years of travel in Central Asia have impressed upon me the importance of the geographic basis in the study of the anthropological sciences. Hence this book. It is an attempt to describe Central Asia in such a way as to show the relation of geography to history and the related sciences, and to show the immense influence which changes of climate have exerted upon history.

From the Caspian Sea on the west to Manchuria on the

east, Central Asia is largely a country of deserts. It is politically divided into the countries of Persia, Afghanistan, Baluchistan, northern India, Tibet, China, and Asiatic Russia. It varies in elevation from the low depression of the Caspian Sea and the small basin of Turfan, lying three hundred feet below sea-level in the very heart of Asia, to the plateaus of Tian Shan, Tibet, and the Pamirs at an elevation of from 10,000 to 20,000 feet above the sea. Although usually the mountainous parts are comparatively rainy and are often well covered with vegetation, the lowlands, which comprise most of the country, are intensely dry and almost absolutely desert. The people are equally varied, the fierce Afghan being as different from the sycophant Persian, as is the truculent Mongol from the mild Chanto of Chinese Turkestan. Yet in spite of all this, not only the physical features of the country, but the habits and character of its inhabitants, possess a distinct unity; for all alike bear the impress of an arid climate.

Central Asia, more fully perhaps than any other part of the world, exemplifies the great geographic type in which the topography, vegetation, animal life, and human civilization have developed along the lines characteristic of prolonged aridity. We all know something of arid countries, empirically or from observation. We need, however, a more general concept, so that the term "arid" shall bring to mind the essential features of a definite geographic type, just as the term "bovine" brings to mind the spreading horns, large eyes, heavy body, cloven hoofs, cud, and other essential features of a definite zoölogic type. If once the geographic type is well understood in its highly developed

form in Central Asia, it will be easy to comprehend how similar conditions of climate in other parts of the world give rise to similar topographic features, and how the two combine to determine the distribution and nature of life of all forms.

The rainfall of Central Asia is so small that the rivers fail to reach the sea. Hence the whole of a vast region, stretching three thousand miles east and west, and having an area nearly equal to that of the United States, is made up of enclosed basins, from which there is no outlet. Each consists essentially of a peripheral ring of higher land, — usually mountainous, but sometimes merely a broad, gentle arch, — within which a desert plain of gravel, sand, and clay, brought from the mountains by rivers, surrounds a salt lake, or the saline beds whence the waters of an ancient lake have evaporated. Where the peripheral ring of higher land is at all mountainous, it is flanked, and often half buried, by vast slopes of barren rock-waste — typical piedmont deposits of gravel, washed out from the uplands by floods. Because of the aridity, vegetable life is scanty except along the courses of streams and in the rainy plateaus. Far less than a tenth of the country is permanently habitable: the rest is either absolute desert, or mitigated desert which supports vegetation part of the year, but is too dry among the plains, and too cold among the mountains, to allow permanent occupation. Hence the inhabitants must either live in irrigated oases along the rivers, or wander from place to place in search of pasture for their flocks. There are no manufacturing communities, either large or small; no commercial centres except local bazaars; and no con-

tinuous agricultural population, such as that of the Mississippi Valley, dependent on rain for its water supply. Two main types of civilization prevail: the condition of nomadism with its independent mode of life, due to the scattered state of the sparse population, and the condition of intensive agriculture in irrigated oases with its centralized mode of life, due to the crowding together of population in communities whose size is directly proportional to that of the streams. Because of the arid climate and the consequent physical characteristics of Central Asia, its types of civilization have been, are, and probably must continue to be fundamentally different from those of well-watered regions such as most of America and Europe.

My acquaintance with Central Asia began in 1903, when I was appointed by the Carnegie Institution of Washington to assist Professor William M. Davis of Harvard University in the physiographic work of an expedition to Russian Turkestan, under the lead of Mr. Raphael Pumpelly. I remained in Central Asia from May, 1903, to July, 1904, spending most of the time in Russian Turkestan. I crossed into Chinese Turkestan for a month, however, the first summer, and spent four months in eastern Persia during the winter. The results of the expedition are recorded in "Explorations in Turkestan," a volume published by the Carnegie Institution. The following year I had the good fortune to be invited by Mr. Robert L. Barrett to accompany him on an expedition to Chinese Turkestan. Arriving in India in February, 1905, we proceeded north to the Vale of Kashmir among the Himalayas, crossed them in May, and reached Chinese Turkestan in June. There we worked

together for two months, and then undertook independent expeditions, Mr. Barrett going east from Khotan to China Proper, while I went east by another route to Lop-Nor, and then, turning north, arrived at Turfan in March, 1906, and reached home the following May via Siberia and Russia.

The journey through Chinese Turkestan from India to Siberia forms the main theme of this book, but I shall devote a few chapters to other parts of Central Asia. This volume, like the majority of so-called "geographical" books, is a description of a journey; but, as I have already said, it is also an attempt to describe certain parts of Asia as illustrations of the great principles of geography. My conception of that science, as stated above, is the one which has been spread abroad in the world at large, and especially in America, during the last few years by the persistent labors of Professor Davis. According to his definition, geography is primarily the study of the various natural divisions or provinces of the earth's surface as illustrations of the relations between the inorganic physical facts of the earth, air, and water on the one hand, and the organic facts of the vegetable, animal, and human world on the other. To illustrate: The investigation of the structure, origin, form, and climate of a lofty plateau and a neighboring arid plain is not geography, but geology, physiography, or meteorology. Neither can the study of the methods of plant growth and animal nutrition rightly be called geography, but botany or zoölogy. When, however, we consider the fact that because of the elevation of the plateau its climate is such that grass grows abundantly in summer; while the plain, being

lower, has less rainfall, and bears only a sparse growth of grass in the early spring, we at once bring in the element of *relation* between the organic and the inorganic, and the study becomes geography. For the purposes of geography, it is only necessary to understand enough of the plateau, the plain, and the grass to gain a clear conception of how the one acts on the other. If animals inhabit the country, they must be such as can live on grass, or can prey on their grass-eating companions. Further, if the plain is waterless in summer, and the plateau is deeply buried in snow in winter, the animals must perforce migrate, and a new geographic factor is introduced. When man enters the region, he finds it too dry in one part and too cold in another for agriculture. Hence he must live upon animals, either as a hunter, or, when the population becomes a little denser and the wild animals diminish in number, as a shepherd. In either case he must wander from place to place. Such a nomadic life induces certain habits as to cleanliness, eating, traveling, sleeping, working, resting, and the like. The habits in turn develop certain moral qualities, such as gluttony alternating with abstemiousness, hardihood under physical difficulties, laziness, hospitality, and others. Thus the physical features of the region give rise to certain kinds of vegetation, which in turn determine the species and movements of animals, and so cause man to adopt the nomadic life. And man, because he happens to be a pastoral nomad, develops certain habits, physical, mental, and moral, which, taken together, constitute character. Geography, it seems to me, cannot logically be content, as many geographers would have it, with the mere description of physi-

cal features and of their influence on the distribution of living species. It must deal with a given region, or natural province, as a whole; and must describe the entire assemblage of organic forms which result from a specified group of inorganic controlling features. The description is not complete unless it includes the highest and most interesting realm of geography, — the influence of physical environment, directly or through other forms of life, upon the mental and moral condition of man.

In accordance with this view of geography, I shall describe some of the chief and most typical physical features of Central Asia, not for their own sake, but as a preparation for the study of their relation to life. Then I shall set forth certain events, conversations, and scenes which fell within my own experience, and shall show how they illustrate the influence of the physical environment already described upon the habits, thought, and character of the people. The descriptions centre in five basins located in northern India, western China, eastern Persia, and Asiatic Russia. The first basin, that of Kashmir, lies among the Himalaya mountains. Unlike the others, it has sufficient rainfall, so that it is not self-contained, but is drained by the Jhelum River, which flows out through a gorge in the surrounding mountains and reaches the sea. Hence the conditions of life are different from those of Central Asia in general, and resemble those of moister countries, such as Italy. The next three basins, those of Lop and Turfan in China, and Seyistan (Sistan, or Seistan) in Persia, are so arid that their rivers either dwindle to nothing in the desert, or end in shallow salt lakes. They closely resemble one another, and

when the main features of one have been comprehended, but little need be added as to the others. The last basin, the so-called Aralo-Caspian depression, possesses many of the characteristics of its more arid neighbors, but its great size and the absence of mountains to the north give it a diversity of climate unknown to the others. I shall not consider it except in relation to the problem stated in the next paragraph.

In the study of the five basins along the lines of the definition of geography given by Professor Davis, I discovered a number of facts which lead to a new application of the geographic principle of cause and effect. In order to understand the present condition, that is the geography, of Central Asia, we must look upon it not as the result of the long-continued action of *fixed* physical conditions, but as the result of *changing* conditions. During the recorded occupation of the country by man there appear to have been widespread changes of climate. It has long been surmised by historians that certain parts of Asia have been growing more arid, but the surmise has lacked scientific confirmation. Indeed, meteorological data seem to stand directly opposed to it, for they show that there is no evidence of any appreciable change since records have been kept instrumentally. The oldest records, however, date back little more than a hundred years, and hence cannot be considered as proving anything in regard to antiquity. The data which I obtained in Central Asia, on the other hand, confirm the surmise of the historians. There is strong reason to believe that during the last two thousand years there has been a widespread and pronounced tendency toward

aridity. In drier regions the extent of land available for pasturage and cultivation has been seriously curtailed; and the habitability of the country has decreased. In certain moister districts among the mountains, on the other hand, the change has been beneficial: they have become less damp and snowy, and hence more habitable. Moreover, in both the drier and the moister regions the change of climate does not appear to have been all in one direction. After a period of rapidly decreasing rainfall and rising temperature during the early centuries of the Christian era, there is evidence of a slight reversal, and of a tendency toward more abundant rainfall and lower temperature during the Middle Ages.

In relatively dry regions increasing aridity is a dire calamity, giving rise to famine and distress. These, in turn, are fruitful causes of wars and migrations, which engender the fall of dynasties and empires, the rise of new nations, and the growth of new civilizations. If, on the contrary, a country becomes steadily less arid, and the conditions of life improve, prosperity and contentment are the rule. There is less temptation to war, and men's attention is left more free for the gentler arts and sciences which make for higher civilization.

The main outlines of the history of Central Asia agree with what would be expected from a knowledge of the changes of climate through which the country has passed. The favorable changes coincide with periods of prosperity and progress; the unfavorable with depression and depopulation. My own investigations show that the parallelism between climatic changes and history applies to an area extending at least three thousand miles, from Turkey on

the west to China Proper on the east. Other evidence, which has not as yet been investigated in detail, indicates that the parallelism applies to all the historic lands of the Old World and possibly to the New. As we look back into the past, we are forced to the conclusion that whatever the motive power of history may be, one of the chief factors in determining its course has been geography; and among geographic forces, changes of climate have been the most potent for both good and bad.

In the last chapter of this book I shall consider this conclusion in its broader outlines as part of the philosophy of history. For the most part, however, I shall confine myself to a statement of the phenomena which have led to its adoption. Briefly restated, the fundamental idea of this volume is that geography is the basis of history. The physical features of the earth's surface limit the organic inhabitants of a given region to certain species of plants and animals, including man, which live together in mutual dependence. The world is naturally divided into geographic provinces characterized by definite organic and inorganic forms. Among primitive men the nature of the province which a tribe happens to inhabit determines its mode of life, industries, and habits; and these in turn give rise to various moral and mental traits, both good and bad. Thus definite characteristics are acquired, and are passed on by inheritance or training to future generations. If it be proved that the climate of any region has changed during historic times, it follows that the nature of the geographic provinces concerned must have been altered more or less. For example, among the human inhabitants of Central

Asia widespread poverty, want, and depression have been substituted for comparative competence, prosperity, and contentment. Disorder, wars, and migrations have arisen. Race has been caused to mix with race under new physical conditions, which have given rise to new habits and character. The impulse toward change and migration received in the vast arid regions of Central Asia has spread outward, and involved all Europe in the confusion of the Dark Ages. And more than this, the changes of climate which affected Central Asia were not confined to that region, apparently, but extended over a large part of the inhabited earth. Everywhere they were the most potent of geographic influences, working sometimes for progress and sometimes for destruction. Such in brief is the broad conclusion to which we are led by a study of Central Asia as an example of the influence of geography upon history. Before accepting it, it behooves us to examine with the closest scrutiny all the evidence in relation to climatic changes which may have been so momentous in the world's history.

CHAPTER I

THE VALE OF KASHMIR

"Who has not heard of the vale of Cashmere,
With its roses the brightest that earth ever gave,
Its temples, and grottos, and fountains as clear
As the love-lighted eyes that hung over their wave?"

THOMAS MOORE.

WE had expected to find Kashmir idyllic, a green sunny vale full of rivers, and surrounded by the grand scenery of the snowy Himalayas. Imagination conjured up a smooth plain of soft green turf covered with a network of winding canals and rivers, dotted with shady orchards and bright with gardens of rare flowers. We expected to see groves of stately chenar trees sheltering mossy thatched cottages, the homes of a gay, happy people, with dark eyes, dark hair, fair olive skins, and handsome features. The picture included clear blue lakes, and a ring of enclosing mountains, green and heavily forested on the lower slopes, with deep, mysterious gorges, where vine-covered ruins of ancient temples stood beside the cascades of laughing brooks tumbling down in sheets of spray. Far above the forests of Himalayan pine and of the deodar, with the almost naked central stalks of its cones pointing straight upward like brown Christmas candles, we looked for the superb cold heights of the lofty Himalayas, where snow and winter reign eternally.

Our picture was not wrong, but it presented only one, and that the loveliest, of the many aspects of Kashmir. The scene was very different on the 18th of March, 1905,

when Mr. Barrett and I gained our first view of the famous mountain-girt vale. As we stood on a snowy hill-top and looked out over the plain, nearly as large as the state of Connecticut, a cold wind made us shiver. There was no sunlight, and no verdure; no forested mountains or prosperous villages could be made out; the whole plain, far below us, was dull brown, save where it was broken by the slaty streaks of rivers and the leaden expanse of Wular Lake. Ominous, low-lying clouds hid the sun, the sky, and the mountains; and the plain, snow-flecked on the edges, was as bare as an Illinois prairie in December. We turned away in disappointment, and began to descend toward the village of Baramula on the Jhelum River.

As we came down the hillside to the lower slopes, from which the snow had disappeared, half a dozen natives sprang up from the dead brown grass, where they had been squatting on their heels, each by himself. Evidently they had been lying in wait; and now from all sides they converged upon us with alarming eagerness. I thought of two occasions when the pursuit of geographic knowledge had led to my arrest as a spy in Turkey, and of the disagreeable enforced ride of two days under guard to the provincial capital the first time. I remembered a fierce Russian colonel who had tried to arrest me in Transcaspia, simply because, as the guest of a civilian official, I had dared to travel on a military railroad where foreigners are not allowed. I recalled the company of nondescript Afghan soldiers who had been called out to prevent me from entering their country. Forgetting that we were under the British flag, I said to myself, "There come the police. How have they found out so

quickly that we are geographers? Do they think that we have come to spy out the land?"

Meanwhile they had reached us. One brandished an official-looking document suggesting a warrant; a second waved a photograph; a third held a drawing like the plan of a ship; and the others carried open letters. They all thrust their papers into our unwilling hands, and in the broken English now spoken by many natives of Kashmir, shouted in rivalry: —

"Master! Master! read this!" — "This my boat; very best boat." — "Master, you looking my boat. Twenty rupee." — "I got best boat. I am six men." — "Come, master, see my boat!"

In spite of protests they escorted us to the village; helped us through the mud, which was six inches deep; led us between the two-story houses of wood, covered with pyramidal thatched roofs green with grass; and brought us to the collection of house-boats on the muddy river. We thought of the jolting of the two-story, two-wheeled carts in which we had been traveling, and of what would await us at our destination, Srinagar, the capital of Kashmir, either a poor and expensive hotel, or its alternative, a wet camp with no proper servants. As speedily as dignity would allow, we yielded to our captors, engaging Subhana Benares, the boatman who claimed to be six men, together with his father, four brothers, a sister, two wives of some of the family, a modest house-boat with four small rooms roofed with reed-matting, a smaller kitchen-boat where the natives were to live and cook, and a rowboat, — for all of which, including people and boats, we were to pay thirty-five rupees (eleven

dollars and twenty cents) per month. Other expenses were correspondingly low, even though Subhana considered it necessary for his two "Sahibs" to have five or six pounds of "soup-meat" a day and other articles in corresponding amounts. There always seemed to be great quantities to "throw away," as Subhana carefully phrased it, when he carried things off to the crowded kitchen-boat. Nevertheless, our seventeen days in a house-boat proved economical. They also, I regret to say, proved cold and uncomfortable, because of the time of the year.

We had come to Kashmir from Bombay. On leaving the railroad at Rawal Pindi in northern India, our plan was to cross the Himalaya mountains to the vicinity of Lake Pangong, three hundred miles to the east, at the extreme western end of Tibet. There we proposed to turn to the north, and traverse the lofty western extension of the Tibetan plateau to the Kwen Lun mountains, a hundred miles away on its northern edge. If we could cross a favorably located pass over the mountains, a further march of seventy-five miles as the crow flies would bring us to the Chanto oasis of Khotan in Chinese Turkestan, where the most important part of our work would begin. We followed this plan as closely as the circumstances would permit, but the exigencies of travel, combined with the demands of geographic investigation, caused us to journey twice as far as the distances specified above. The main features of our route appear on the map at the end of this volume. Leaving Rawal Pindi March 13, 1905, we reached Srinagar March 21, and remained there till April 4, when we started for Leh, the capital of Ladakh, where we arrived April 24.

Between this date and May 15, Mr. Barrett remained in Leh, while I visited Lake Pangong. Then, starting north across the great plateau, we reached Sanju, on the border of the plain of Chinese Turkestan, June 22, and Khotan July 11.

The part of the Himalayas which we crossed trends northwest and southeast in three parallel ranges. The front or southwestern range rises from the warm, low plains of northern India to an altitude of 15,000 feet in many places. Beyond it, toward the northeast, the basin of Kashmir, at an elevation of from 5000 to 6000 feet above the sea, interposes a smooth plain between the front range and the higher middle range. Still farther in the same direction, the narrow valley of the Indus, which here flows to the northwest, lies at an elevation of from 8000 to 13,000 feet between the middle range and the still more remote and lofty main or Ladakh range on the southwestern border of the great plateau of Tibet and Karakorum.

In order to reach Kashmir, we crossed the front range by the only low pass, that of Abbotabad, 5000 feet above the sea, and came up the Jhelum River in the "ekkas," shown at page 19, two-wheeled native carts, drawn by one horse. We put our baggage in the lower story and sat in the upper, sometimes cross-legged behind the taciturn, dark-skinned Mohammedan drivers, and sometimes beside them. Often the men got out to walk with their horses, and to feed them with great sticky lumps of crude sugar with bits of cane still in it. We, too, walked much of the time, and acquired keen appetites for the remarkably delicious omelets and desserts which some of the native cooks managed to pre-

pare at the "dak bungalows" where we spent the nights. We had not been able to find a satisfactory servant to act as interpreter, so we talked by signs much of the time, and found it surprisingly easy.

Kashmir is an excellent example of a kind of warped basin found in many parts of the world. It is like an elliptical tray, a hundred miles long from southeast to northwest and forty or fifty wide. The rim consists of the front and middle ranges of the Himalayas, which merge at either end. The slopes of individual mountains are very steep, but the rim as a whole is about two miles high and ten times as wide. During the course of ages, the bottom of the tray has been warped downward and the rim has been warped up. The Jhelum River has sometimes, perhaps, been checked by the rising rim; and the lower part of the tray has been converted into a lake. In general, however, the river has been able to cut its way across the gradually rising mountains just as a circular saw cuts its way into a piece of wood thrust against it. The result is the deep gorge of the Jhelum, the peculiar course of which to the southwest of Kashmir appears on the map. The gorge is so narrow and impassable in its lower portion that the famous Murree road, the chief exit from Kashmir, is obliged to leave it and climb five thousand feet over a pass in order to reach Rawal Pindi, a few miles west of the point where the river emerges on the main plain of India. While the Jhelum has been cutting its gorge, the basin of Kashmir has been receiving vast deposits of gravel and silt, brought down by the numerous swift streams from the mountains, and deposited on the flat basin floor to a depth of hundreds or thousands of

feet. The coarser materials have been laid down on the edges near the mountains, and have been terraced, which shows, as we shall see, that the region has been subject to great variations of climate in the not far distant past. The finer materials have been carried toward the centre of the basin, where they form a smooth plain, free from pebbles, very fertile, easily tilled, and easily watered by canals from the countless mountain brooks and rivers.

We are apt to think of Kashmir as part of India, and therefore as necessarily warm. As a matter of fact, it lies thirty-four degrees north of the equator, in the same latitude as the northern part of South Carolina. In altitude it stands over 5000 feet above the sea. Consequently the climate is comparatively cool. From November to March, it is so cold as to be not only bracing, but even rigorous. The spring and fall are mild and delightful, and the summer is warm. The great amount of water spread over the plain for irrigation, and the summer storms on the mountains, make that season damp, though but little rain falls on the plain. The precipitation of Kashmir itself, about twenty-five inches a year, mostly snow, is not much more than half as much as that of the eastern and central parts of the United States. On the mountains the snowfall is heavier, and hence the rivers and canals of the smooth plain are always abundantly supplied with water for irrigation. The temperate climate of the region, combined with the beautiful scenery, makes Kashmir a most attractive summer resort for the people of India, especially the English.

From the dawn of history, Kashmir has been occupied by a single race, Indo-Europeans, allied in blood and language

to the people of the plains south of the Himalayas. The wall of mountains encircling the Vale has not only made invasion a rare occurrence, but has restricted external trade and migration. Hence the Kashmiris, as the inhabitants are called, have been left largely to work out their own destiny undisturbed by outside influences. Three religions have prevailed successively,—Buddhism, Brahmanism, and Mohammedanism; and each has doubtless had its appropriate effect. Nevertheless, according to Stein, the chief authority on the history of Kashmir, the character of the mass of the people seems to have changed but little since the Buddhist days, thirteen centuries ago, when the keen Chinese pilgrim, Hwen Tsiang, described the Kashmiris as "light and frivolous, and of a weak, pusillanimous disposition; handsome in appearance, given to cunning, fond of learning, and well instructed." Apparently, the character of the Kashmiris of to-day is largely the result of modifications produced by physical environment upon the racial traits which the original settlers brought with them.

Because of the difficulty of crossing the mountain passes, Kashmir has always been isolated; strangers have rarely visited the country; the natives have not often gone out. Hence, as has been often said, the Kashmiri has become cowardly, exclusive, and suspicious. Until lately he has hated and feared the few foreigners whom he has seen, has suspected them of designing evil against himself, and, naturally, has tried to keep them out. The cowardice of the Kashmiri outside Kashmir is proverbial; and at home it is laughable. Several times in the street, when I met men and unexpectedly turned on them, or asked them questions,

no matter how mildly, they started and trembled as though threatened with a pistol; and this is said to be a common occurrence. Mr. C. E. Biscoe, head of the large schools of the Church Missionary Society, which even the natives generally recognize as the best in Kashmir as to both education and character-building, introduced compulsory exercise into the curriculum a few years ago. At first the boys, chiefly Brahmins, with a smaller number of Mohammedans, were abjectly afraid of the water, though they had lived near it all their lives. In order to make them learn to swim, it was actually necessary to throw them into the canals. Now, however, they have learned to do fine work both in and on the water, and during the last great flood, which half submerged Srinagar, saved much property and some lives. To be sure, they are still cowardly; but there has begun to be a school spirit, which makes them ashamed to show their fears. Similarly, in football, the boys at first ran away from one another; but now many of them stand up pluckily and run the risk of getting hurt, which shows that though isolation may have made the Kashmiris cowardly, they have a certain amount of moral fibre capable of cultivation.

Exclusiveness was carried so far in Kashmir in the Middle Ages that practically all foreigners were kept out, just as has been the case more recently in Tibet, perhaps for similar physical reasons. Even to-day, in spite of the incorporation of Kashmir in the British Empire, the old ideas prevail so far that no foreigner can remain in the Vale without a permit — renewed, I believe, annually; nor can a foreigner buy or build a house or own land. Natives, or the nati-

government, build to order. That is one reason why house-boats are so common; for in a boat, not only does the landlord become one's servant, but one can move about freely. To people who are on the outside and want to get in, the seclusion of Kashmir seems a bad quality; but it has at least one advantage. Drew relates how, on the Pir Panjal pass, to the south of Kashmir, at an elevation of 11,400 feet, he "found the ground and the snow for two or three miles' distance strewn with dead locusts [a pest on the plains to the south], which about the middle of May had been destroyed by the cold in an attempted invasion of Kashmir."

The climate of Kashmir is comparable in some respects to that of the northeastern part of the United States, although the sun is hotter because of the more southerly latitude; the summers are more trying because the heat is more rarely interrupted by showers and cool storms; and snow falls earlier in the autumn because of the great altitude, so that the crops are sometimes ruined by it. The second day of our stay in Kashmir (March 19) was warm and clear. Our boat was being towed slowly eastward up the river by the boys and girls of our native family, who trudged barefoot along the towpath at the rate of less than two miles an hour. A stroll on shore in the bright sun among thatched houses surrounded by orchards, or beside broad pools, with glimpses of hunters shooting waterfowl with huge blunderbusses, and a clear view of the wonderful ellipse of snowy mountains encircling the plain made us realize that Kashmir can be idyllic. Most of our twenty-two days in the basin, however, were cold and raw, with several frosts and a little snow, so that we sympathized

with the natives, who went about with "gungris" under their long, dirty, white cotton gowns. The "gungri" resembles a large flower-pot made inside a wicker basket, with a protective wicker handle, like the arches of a half dome. When filled with live coals it serves to warm the hands — or, oftener, the whole body — by being put under the loose outer robe of either man or woman and held over the stomach, whether the people are walking or sitting. It is essentially a lazy man's device; for no one can hold it and work, and it reflects the habits of the Kashmiri, especially of the farmer, who in the snow and mud of winter has nothing to do.

The abundance of the water supply of Kashmir and the smoothness and softness of the fine soil of the plain have led to the formation of an intricate network of deep, slow-moving waterways, partly natural and partly artificial, difficult to ford but easy to navigate, and often overflowing. Hence, as Stein points out, the roads are very bad; and as outside traffic is largely shut out by the mountains, beasts of burden are rare, wheeled vehicles are practically confined to the single new thoroughfare down the Jhelum, and traffic is carried on in boats, the loads being usually borne for short distances on men's backs. Almost every village is said to have its landing-place, either close at hand or a mile or two away; and in Srinagar the crowded river and the larger canals are the main thoroughfares.

Another effect of the abundant water and fine soil, together with the hot summer sun, is great fertility. Therefore food is plentiful and cheap. Rice is naturally the chief crop; and though other grains grow well, they are of second-

ary importance. The water-chestnut, shaped like a pair of stocky cow's horns and dredged from the bottoms of the streams; many kinds of greens and vegetables, of which great quantities are eaten; and fruit, especially apples and pears, are other profitable crops. Cheap food may be a blessing, but in Kashmir one is inclined to doubt it. It seems as though the ease with which a living can be made were the chief cause of the reputed idleness and laziness of the people; and laziness, aided, perhaps, by the opportunities for dishonesty afforded by the large amount of local traffic and barter which the abundant waterways foster, may be responsible for much of the untrustworthiness which is said to be so prominent a trait of the Kashmiris. In this respect the latter are like the people of many parts of India; though they are not so lazy, perhaps by reason of the invigorating winter climate of their mountain home.

Our own life during the two weeks which we spent in Srinagar in our house-boat was a direct response to the abundance of water, the smooth plain, the fertility of the soil, and the consequent cheapness of the necessaries of life. Like most travelers to Kashmir, we lived in a leisurely fashion. The snow on the passes delayed our start across the mountains, and the slowness of the people prevented haste of any sort. We were not eager to get away, for the houses of wood or brick, with their green grassy roofs, were most quaint; and the orientalism of the narrow, dirty streets and the busy life of the pleasanter canals were always of fresh interest. We went sight-seeing in our own "shakari," or flat-bottomed boat, with three or four oarsmen. Brahmins squatted naked on frosty mornings while they bathed at the foot of

steps leading to little temples with high, top-heavy silvered domes; market-women passed down the canal with boat-loads of spinach and turnips from the floating gardens in the Dal Lake, mere rafts of water-plants strewn with a little earth; merry children in twos or threes sang musically at the tops of their voices; and men clothed in dirty white walked briskly along the embankments beside the canals, under the fine bur-covered chenar trees, just as old Hwen Tsiang reports them to have done long ago. Except for the fast walking, — fast compared to that of India, — the general appearance was leisurely. The Kashmiris, as has been said, have a reputation for laziness; but when I watched them working, they seemed to show a good deal of energy and steadiness, though perhaps it was only to keep warm. Along the canal where we anchored, at least a dozen house-boats were being built for the accommodation of summer visitors. All the timber was sawed into planks on the spot by hand. The men who worked the big saws, one at either end, kept at work steadily, though the labor is tiresome, and twice during ten minutes I noticed that when one of a pair had to stop for something, his comrade went and helped some one else.

Within the last few decades, a new factor has entered into the geographic development of Kashmir — namely, the attraction exercised by its climate and scenery upon the British sojourners in India. The æsthetic element of love of scenery and the rational element of choosing a place for a home for the sake of its favorable climate, though strictly geographic factors, exist only in highly civilized communities. Therefore, in the past they have been of

small importance; but as their significance is more and more appreciated, it is probable that they will exert a growing and even a preponderating influence upon the distribution of intelligent people in countries not blessed in general with the invigorating climate of the cool temperate zone. To-day, for instance, India is governed from the small hill-station of Simla rather than from hot Calcutta; and retired Indian officers and civil servants who cannot return to England are beginning to see in Kashmir a place where it is possible to settle permanently in spite of the restrictions imposed by the native government. Already the great influx of summer visitors has caused a considerable number of Kashmiris to become servants or keepers of house-boats; a distinct impetus — not always beneficial, because it encourages the use of cheaper, less durable dyes — has been given to the highly developed native arts of rug-weaving, shawl-making, and embroidery; and the merchant class, though always noted for their habit of fastening on a victim, have become more rapacious than ever. Indeed, the merchants are the bane of the foreigner's life in Srinagar. They come in boats and on foot; in the guise of beggars and of princes; before sunrise, at noon, and at night; they dog one if he goes for a stroll; they sit on the bank and wait for hours to pounce upon the chance visitor. When we first tied up to the bank of the canal in Srinagar, Subhana, our factotum, suggestively laid by the door a little willow cane which might have served as a whip, and, in answer to our inquiries, remarked laconically, "For merchant." He evidently appreciated two national traits — the choleric temperament of the British officer from India and the

impudent persistence of the otherwise timorous Kashmiri merchant. A typical specimen of the latter stood on the muddy shore one day as I sat on deck in the rare sunshine, and, holding up a gaudy red felt, began: "See, master, here *numda* [felt] very cheap. Master buy him cheap." No reply from the traveler.

"Only look, master. No buy; only look." A pause. "You wanting other kind felt? I bringing him, very best." Still no reply.

"I good man, master, honest man. Read my letter" (holding out a well-thumbed bunch wheedled out of a score of foreigners whom he had cheated). "Only read, master. I not like other man. I good man."

"No, put them up; I don't want your felts," I answered at last.

"I got boots, master,"—trying a new tack. "I am leather man. I new man. I no been here before, master," He had been there an hour a day for three days, had tried to intercept us as we went to make a call, and had shouted to us from the bank as we rowed down the main canal.

Long interval, broken only by such remarks as "Very good," "Cheap," "Only look," "Oh, master, look!"

At last a new effort. "What time you say I coming tomorrow morning? Eight o'clock? Very well. I bringing many shoe."

Half an hour of this sort of thing made me regret that the cane had been put away.

The problem of transportation furnishes another illustration of the influence which the invasion of Europeans in summer is having upon Kashmir. On leaving Srinagar

on our way to Ladakh or Little Tibet, two hundred miles eastward across the main range of the Himalayas, we first spent a delightful spring day in floating slowly ten miles westward down the Jhelum, and in being towed still more slowly seven miles northward up the tributary Sind to the head of navigation at Gunderbal. There we dismissed the house-boat; and then, for two short stages, shaggy little ponies, secured as a right from the villagers by means of a pass from the British Resident at Srinagar, carried us eastward up through the lovely scenery of the Sind valley — among spreading walnut trees (often used as haystacks), among mossy rocks, dashing brooks, and straw-thatched houses. On April 6, at an elevation of about 7000 feet, we encountered snow too deep for horses, and were obliged for nine days to walk and have the loads carried by coolies. When the first detachment of men was being procured at Gund, a great uproar in the muddy courtyard called us out from our smoky, windowless room to the second-story balcony, among the cows which had ambitiously mounted the broad flight of stone steps. In their usual fashion, the chief men of the village were delaying matters because snow was falling and the road might be bad. Our headman, a remarkably trustworthy and energetic Mohammedan from Ladakh or Little Tibet, had knocked down one village official into the mud, and had beaten another with a stick. Nobody seemed resentful, and nobody stopped talking. Apparently, they looked upon violence as the logical result of their obstructiveness; but not enjoying it, they speedily gathered the necessary band of thirty-five coolies. The latter did not want to go. Who would, if he had to carry a

sixty-pound load over roads where even the unloaded "Sahib" grows weary? For six days the same band of coolies trudged through the deep snow. The first day rain fell, and our pathway was full of slush. The coolies wore nothing on their feet except grass sandals, a pair of which only last a day or two. At the end of our day's journey we stopped at one of the little "bungalows," or rest-houses, built by the government. The men sat down by a fire in a dark room full of pungent smoke, dried their feet and clothes, ate their supper of bread, and set to work to repair their sandals, or to make new ones from the bundles of grass which they had brought with them. The next day was clear, and the hot sun, reflected from the fresh snow, burnt our faces in a way troublesome even to the hardened coolies. By ten o'clock the snow had begun to melt, and to thunder into the narrow valley-bottom in avalanches. More than once the men began to run, thinking that the snow was about to overwhelm them. Fortunately, no avalanche quite reached us, although toward noon the roar was almost continuous as the snow plunged down on every side. The finest avalanches were those which came down little gullies in the steep mountain side, and at the bottom cascaded into the main valley. The precipices, over which they fell in spray, were due apparently to the steepening of the lower part of the valley sides by ancient glaciers which have now retired.

The third day, like the second, was clear and painfully sunny. As we were now above Sonamarg, where the valley has been much broadened by glacial erosion, all danger from avalanches was at an end. Nevertheless, we could see and hear them on every side; and long white streaks among

the pines showed where unusually large avalanches had swept away all the trees. It was colder now, for we were at an elevation of over 8000 feet. As the snow was dry, the men swathed their feet and legs in crude "putties," mere strips of woolen cloth, wound round and round and tied with strings. We spent the night in a so-called rest-house, a mere shed, where no one could rest because of the smoke. A tremendous wind swooping down the valley woke us at two o'clock, and at three we were under way. In the clear light before sunrise we tramped through the cold blue shadows on the hard crust to the top of our first great Himalayan pass, Zoji La, 11,300 feet above the sea.

The men's wages, according to the official scale, were eight cents a day, except for especially hard stretches, where they got ten. As nothing is ever paid for the return journey, four or five cents a day was all that they were entitled to for the most exhausting labor; but the means of supporting life in Kashmir are so cheap that with this they were able not only to pay for their own food, chiefly bread and rice, but to support their families. In spite of their unwillingness to go, the men seemed cheerful in their stolid way, and chattered like magpies when they came in for the night. A present of a little tea all around made them quite jovial.

The bearing of burdens by coolies is a necessity, if communication is to be kept up among the snowy mountains of Kashmir; but its influence is distinctly bad, encouraging brutality and violence on the part of employers, and engendering deceit, laziness, and selfishness in the men-of-burden. Our coolies engaged in regular fights for the lightest load,

and some of the more clever ones constructed mock loads by wrapping a rope or some other light, bulky thing in cloth and staggering off with it. Nothing but government compulsion could make them do the work except for exorbitant hire, although they are accustomed to carry their own loads on their backs. If the people should become more educated or more independent, they would refuse to act as coolies, and some new means of transport would be necessary. Among the changes which will in time come to Kashmir, the introduction of a new system of transportation among the snowy mountains may perhaps be reckoned; for on the one hand, education is beginning to spread, though as yet it is limited largely to the cities, and on the other, the demand for coolie labor and the disinclination of the people to perform it are increasing with the growing invasion of Kashmir by English tourists and sportsmen.

The old order is passing away in the Vale of Kashmir, and it may not be long before the simple geographic conditions produced by the long and undisturbed residence of a homogeneous race in the seclusion of their mountain-girt basin will give place to the complexity arising from a mixture of races and the invasion of new habits and ideas. Since the opening of the new wagon-road down the Jhelum, external trade and intercourse of all kinds have received a powerful impetus; and when the projected electric railroad from Srinagar to Rawal Pindi, run by power from the Jhelum, is completed, the isolation of Kashmir will be almost destroyed. Pronounced changes in trade, and in the distribution, habits, industries, and even character of the natives, together with the development of a new

and comparatively permanent English element of population are likely to follow.

From prophecies of the future to legends of the past is a far cry, but the two are closely related. Both alike depend largely on climate. The earliest description of Kashmir is that of Hwen Tsiang, a pious Chinese priest of Buddhist faith, and a most keen observer. Being disturbed by the discrepancies in the holy Buddhist books, he traveled far and wide in China in order to consult the most reliable manuscripts, but found no satisfaction. Accordingly, he resolved on a pilgrimage to India, the home of Buddha, where he hoped to learn the truth. After many difficulties, occasioned first by the law prohibiting any Chinese from leaving their country and later by the frightful deserts of western China, he reached India. There he remained some years, making a pilgrimage to all the holy places, much as certain Buddhists of high rank from Japan have recently done. On his return to China in 645 A. D. with many precious manuscripts, he wrote a lively account of his journey, full of miracles and wonders, but, nevertheless, very reliable. One of his stories relates the traditional history of Kashmir. According to this story,—which is repeated with fuller details by Kalhana, a native historian of the twelfth century, whose works have been translated by Stein,—Kashmir was long ago covered by a lake, in which lived the demon Jalodbhava (Water-born). The demon caused great distress to all neighboring nations by devastations, the nature of which is not stated. Finally Kasyapa, the father of all fountain-gods, heard of this from his son Nila, the king of the Kashmir fountain-

gods, and promised to punish the offender. He proceeded to the seat of Brahma to implore his aid and that of the other gods. His prayer being granted, the whole host of heaven took up their position on the lofty peaks about Kashmir, and ordered Jalodbhava to leave his watery home. This the demon, who was invincible while in the water, refused to do. Vishnu thereupon called on his brother, Balabhadra, to drain the lake by piercing the mountain with his weapon, the plowshare. When the lake had become dry, Jalodbhava was attacked by Vishnu, and, after a fierce combat, slain with the god's war-disc.

Kasyapa then settled the land of Kashmir, which had thus been produced, the gods as well as the fountain-spirits taking up their abodes in it, while the various goddesses adorned the land in the shape of rivers. At first men inhabited the land only during the six summer months, and withdrew to warmer regions each winter, leaving Kashmir during the cold season to the Pisacas, the vilest and most malignant of Hindu demons. At length, however, after four yugas or ages, the Brahman Caandradera learned certain rites which freed the country from the Pisacas and from excessive cold; and Kashmir became habitable throughout the year. Stein and Drew, two of the most careful writers on Kashmir, regard this tradition as founded not on historical fact, but on inference from the lake-like appearance of the basin, and from the fact that during floods Lake Wular is subject to considerable fluctuations in size. It is possible that the legend of an ancient lake, drained by the plowshare of a god, might originate in this way, but there is nothing in the physical features of Kashmir to give rise

to the circumstantial details of the great cold of antiquity, the long prevalence of winter, the occupation of the country by nomads at first during only half the year, and the later change to conditions adapted to agriculture. The circumstantial character of the legend and the agreement of the details with physiographic facts in Kashmir and elsewhere, as will shortly appear, give ground for believing that the story is founded on fact.

Another legend, also quoted by Stein, relates how, after the drying up of the lake, the site was occupied by a town called Candrapura. A certain holy man, coming to the town and being refused entertainment, cursed it, and foretold its destruction by water. Later, a fountain-god, who visited the country in the guise of an old Brahman, asked and obtained permission to settle in the town, and then out of gratitude revealed himself in his true form and warned the king of the prospective submersion of the city. The king and his people accordingly migrated a short distance westward and, under the god's direction, founded a new town. Then the god took up his residence in the lake, which soon overwhelmed the old city. The natives say that ruins, supposed to be those of this city, have been seen at the bottom of Lake Wular.

Turning from legend to attested history, it appears that Kashmir, now and always, has suffered more or less from famine, due, not to drought, as in so many countries, but to floods, which drown the rice crop. In the time of King Avantivarman, A. D. 855–883, as Stein, on the authority of Kalahana, relates, Kashmir had long been suffering from peculiarly disastrous floods of this sort, and from

the general water-logged condition of the country. Many attempts had been made to mend matters, and at last, to quote Stein, "Suyya, a man of conspicuous talents but low origin, offered to remedy the troubles. The operations commenced at Yaksadara, where large rocks, which had rolled down from the mountains lining both river-banks, obstructed the Vitasta (Jhelum). . . . Yaksadara, the present Dyaragul, is a spur projecting into the river-bed some three miles below the commencement of the Baramula gorge. Its rocky foot forms the first rapid of the river [after it leaves the Kashmir plain]. By removing the obstructing rocks, the level of the river was lowered. Then a stone dam was constructed across the bed of the river, and the latter thus blocked up completely for seven days. During this time the river-bed was cleared at the bottom, and stone walls constructed to protect it against rocks which might roll down. The dam was then removed, and the river flowed forth with increased rapidity through the cleared passage. I must leave it to competent engineering opinion to decide to what extent and at which point of the Baramula gorge the operations so far described were practicable with the technical skill of that age. What follows in Kalhana's account is so matter-of-fact, and so accurate in topographical points, that a presumption is raised as to the previous statements, also resting, partially at least, on historical facts."

Yaksadara, the seat of the operations, lies directly opposite the mouth of a large stream which, in the ten miles from its source near Gulmarg, descends seven thousand feet. It appears as though, at the time of Avantivarman, the large

fan-delta deposited by this stream where it enters the narrow main valley had encroached upon the Jhelum and raised its level, just as has happened at many other places lower down — for instance, at Uri, where the front of the fan was in later times cut off by the river. The process of cutting off the front of the Yaksadara fan, though begun artificially under the direction of Suyya, probably continued naturally during later centuries; for the level of the Wular Lake appears to have fallen steadily, as though the river were slowly deepening its channel by cutting away the fans and other material in the bottom of its valley, thus forming a terrace. In proof of this fall of the lake-level, Stein cites certain villages which Kalhana, 1148 A. D., seems to indicate as having been actually reclaimed from the lake, and which Jonajara, *circa* 1450 A. D., still places on its very edge, although now they are three miles from its border. Similarly, Srivara, *circa* 1480 A. D., speaking of the neighboring villages stretching from Sudarkoth (Sadykoot) to Andarkoth (Andykoot), places them along the shore of the lake, although they are now from four to six miles away. Stein attributes the change in the relation of the villages to the lake to the building up of the delta of the Jhelum, where it enters Lake Wular. This cause, however, though doubtless operative, is inadequate to produce results so great, especially when it is considered that some of the marshy regions to the south of the lake away from the delta have also become drier. The chief cause is probably the lowering of the level of the lake by the deepening of the outlet channel — a process which appears to be still in operation, as may be inferred from the "winding but well-

defined bed" which the river has cut in recent times, and is evidently still deepening, from the outlet of the lake to the head of the gorge.

Putting aside all unnecessary details, the following outline of events appears to fit the legends and facts related in the last few paragraphs. Long ago, in prehistoric times, the basin of Kashmir contained a lake much larger than that of to-day. The lake was partially drained by the deepening of the channel at the head of the gorge of Baramula, where, it should be remembered, the river would encounter only unconsolidated deposits. After this, or at this very time, the climate was so cold, or the winter snows were so abundant and lasted so long, that the country could be inhabited only in summer by nomads who migrated southward in winter. In time, however, the climate moderated, and Kashmir became the abode of a permanent and prosperous agricultural community. At the height of its prosperity, a new difficulty appeared. By reason of the building up of the bottom of the gorge near Baramula, the lake began to expand again, and to overwhelm inhabited villages. Many attempts were made to remedy matters, and success was finally attained, after which the river itself was able to deepen its channel, instead of letting itself be checked by the waste brought in by its tributaries.

The size of the legendary lake of the earliest traditions suggests at first thought that the water supply then was larger than at present. This is not necessarily so; the lake would be most likely to expand in a dry epoch. It is not a question of water supply, as in the case of salt lakes in enclosed basins, but simply of how the Jhelum

River came to be so checked that a small portion of its superabundant water was detained in a lake. At present Wular Lake is about twelve miles long north and south by about six east and west, and, according to Stein, has a maximum depth of fifteen feet. It is surrounded on all sides by alluvial deposits, which have been built up in such a way as to leave at the base of the northern mountains the faint hollow in which the lake lies. The formation of the broad dam, so to speak, which holds back the lake, is due largely to the deposition of alluvial fans by the tributaries which come in from the north and south near the mouth of the Baramula gorge. In a moister epoch the forces of erosion would be less active upon the mountain slopes because of the thicker cover of vegetation; the streams, though large, would not be very heavily loaded with detritus, and the tendency would be to cut away the fans and similar deposits which had previously been laid down, and to drain the lake. On the advent of a drier epoch, on the other hand, the forces of erosion would be more active upon the mountain slopes, and the average size of the fragments carried away would be greater because of the diminution in vegetation and in the number of roots which would hold the soil in place; the streams, especially the shorter, steeper tributaries, would be not only more heavily loaded, but also smaller; and the valley bottoms, with their comparatively gentle slopes, would become areas of deposition. Where the swifter tributaries joined the slower main stream, they would tend to build up fans which the main stream, also diminished in volume and bearing a greater load, might not be able to remove. Thus the fans

would form dams; and, paradoxical as it may seem, lakes would be formed in drier epochs and drained in moister epochs.

From a study of the moraines and terraces of the mountains and valleys around Kashmir, it appears that during the so-called "Glacial" period this part of Asia underwent the same series of climatic changes as did Europe and America. There were at least five complete oscillations from the colder, moister climate of glacial epochs to the warmer, drier climate of inter-glacial epochs like the present. This does not mean, however, that the whole country was shrouded in ice. The glaciers in the mountains expanded somewhat, but the chief characteristic of the colder epochs was the great abundance of moisture manifested especially in the large size and constancy of the rivers. Hence the term "fluvial" is more fitting than "glacial," and I shall use it in referring to the period of great rivers and lakes which forms the Asiatic equivalent of the period of enormous glaciers in Europe. As I have elsewhere considered the fluvial period of Asia in detail, it will suffice here to show how the physiography of Kashmir confirms the legendary account of the country, and how the two are in complete harmony with the evidences of changes of climate which are found in other parts of Asia.[1] As has been already said, many facts in western and central Asia suggest that during the past two or three

[1] For a full discussion of the fluvial period in Asia, see *Explorations in Turkestan*, vol. 1, Publication No. 26 of the Carnegie Institution of Washington, 1905. Later investigation has led me to believe that the five epochs described in that book and referred to above were really *post*-glacial stages representing the pulsatory steps by which the last glacial climate passed away. Similar moraines indicate what are probably synchronous post-glacial stages in Europe and North America.

thousand years the climate of those regions has passed through four successive phases. Up to the first or second century of our era, it appears to have been distinctly colder and moister than at present. Then, for several hundred years, it grew rapidly warmer and drier, until in the fifth or sixth centuries the desert regions were even more arid than to-day. During the succeeding mediæval epoch, the climate again became slightly cooler and moister; while during modern times, there is a general, though slight tendency toward aridity. The earliest legend demands a large lake. Physiographic evidence shows that such a lake was probably formed during the dry interfluvial epoch preceding or possibly synchronous with the occupation of Kashmir by man.

Evidence as to the succeeding epoch is more definite and more completely harmonious. The legend points to a cold period, during which Kashmir was not habitable in winter, and during which the lake that occupied the plain was drained by the cutting of a deeper channel. Physiography, as we have seen in the discussion of the paradoxical origin of lakes, seems to show that if there were a lake larger than that of to-day, it must have been drained during one of the moist epochs of which the terraces furnish independent evidence. In Transcaspia, Persia, and Turkestan, other lines of research indicate that two thousand or more years ago the water supply was decidedly larger than now, the country was colder, and the desert regions were more habitable. Putting together all these conclusions, there seems to be reason for believing that a fluvial epoch, culminating somewhere in remote antiquity, had not yet wholly passed

away at the beginning of the Christian era, and was the time indicated in the legend when Kashmir was too cold to be inhabited, except in summer, by nomads. Even to-day the snowfall of Kashmir is so great that agriculture cannot be carried on at an elevation of much over 7000 feet; and on the plain itself, at an elevation of from 5000 to 6000 feet, early snows sometimes cause disaster by destroying the rice crop. It would need but a slight increase in cold or in snowfall to render the whole country unfit for agriculture and habitable only for nomadic shepherds, who would drive their flocks southward in winter, away from the snow, to the warm, low plain beyond the mountains. Such we may reasonably believe to have been the condition of Kashmir before it appears in history near the opening of the Christian era.

By the sixth or seventh centuries of that era, as history shows, Kashmir had acquired nearly its present prosperous character, and not long after was suffering from the filling of the channel of the Jhelum with detritus from the mountains, and the consequent expansion of the lakes. Such prosperity and such disaster would naturally result from a relatively dry or warm epoch like that which appears to have occurred during the first six or eight centuries of the Christian era. On the one hand, agriculture would be stimulated, and on the other, fans of boulders and gravel would be deposited in the river bed, causing the lake to rise, and perhaps to submerge villages.

As to the possible succeeding mediæval epoch of somewhat lower temperature and greater rainfall, there is little to be said. The deepening of the channel of the Jhelum and

the slight lowering of the level of the Wular Lake are the results to be expected under such circumstances, as are also the famines, which Stein, on the authority of Kalhana, describes as taking place in the twelfth century because of prematurely early snowfalls. Similarly, the complete freezing over of the Jhelum, described by Kalhana in 1087–88 A. D., and the extreme isolation of Kashmir during the Middle Ages, would be natural if the winters were more severe and the passes more snowy than now. Altogether, the history of Kashmir, as well as its present condition and future development, seems to depend upon climate more than upon any other physical feature. Changes of climate appear to have caused a population of a few scattered nomads to give place to a far denser population of tillers of the soil and artisans, whose mode of life and whose character are wholly different from those of wandering shepherds. And the present climate, in coöperation with other physical features, exerts a strong influence upon the habits and character of the people, and upon the lines of development which must be pursued in the future under the changing conditions of English occupation.

CHAPTER II

LADAKH AND THE INFLUENCE OF THE HIMALAYAS

THE habitable portion of the upper Indus valley constitutes Ladakh. Upstream to the southeast in Tibet, the valley cannot be permanently occupied above an elevation of 12,000 feet; downstream from an elevation of 9000 feet to the point where the river emerges on the low plains of India, it narrows to an impassable canyon, where there is no room for habitation. Between the cold gravel plains of Tibet and the magnificent canyon, the sunny province of Ladakh lies warm and contented in its narrow valley. Although governed by the native Indian state of Kashmir, under British regulation, it is essentially Tibetan in character, not only physically, but in respect to race, language, and religion. The people are mainly Buddhists, with a few Mohammedans at Leh and in the western villages.

To resume our narrative where it was interrupted by the account of the ancient climate of Kashmir, we and our coolies had reached the pass, or col, of Zoji La, 11,300 feet above the sea. We were on our way eastward from Kashmir to Ladakh, diagonally across the middle range of the Himalayas, here running northwest and southeast. The pass was fairly difficult, for the ascent from the southwest was long, steep, and snowy, and the descent on the other side toward the Indus, though gentle, was at first through deep snow. The other approaches to Ladakh are much more

difficult. Aside from Zoji La, the passes southwest of the Indus rise to heights of 15,000 feet or more, and those to the north, as we found later, are still higher. The easiest line of communication within Ladakh itself is along the Indus, but this does not furnish an easy avenue of approach from without. Upstream to the southeast, a difficult caravan journey of three months over the snow and barren gravel of Tibet separates Leh from Lhassa, the next important centre of population in that direction. Downstream, where the Indus turns to the south and breaks through the middle and front ranges of the Himalayas, its canyon is so narrow and impassable that it has never been properly explored. Thus the isolation of Ladakh is even greater than that of Kashmir.

As might be expected, there is a radical change when one passes from the moist, forested southwest base of the middle range, with its easy conditions of life, to the northeast side, where most of the moisture from the Indian Ocean is shut out by the mountains, and life responds to a drier, sterner, more bracing climate. The mountains are rocky and bare, naked of vegetation, save for a few scattered weeds and small bushes. Irrigation, the only possible means of raising crops, is far more difficult than in Kashmir. Perennial streams are rare, and the only land smooth enough for cultivation consists of small patches of the extremely stony surface of fluvial fans and terraces. The uncouth dweller among the loftier Himalayas must work hard more than half the year in order to live, while his Kashmiri neighbor across the mountains, whom he despises as lazy, cowardly, and dishonest, can sit idly on his heels much of the time, and yet live comfortably.

There are other equally marked differences between the two sides of the mountains. The Kashmiri's food consists chiefly of rice, with some bread and many vegetables; while the Ladakhi eats bread or parched flour of wheat or barley, with much butter, sour milk, and dried apricots. The Kashmiris wear clothes of woven cotton, or rarely of wool; but the Ladakhis, in a colder climate with greater extremes, need something warmer, which they find in the skins of their many flocks. Men, women, and children wear sheepskins, which take the form of coats with the men, and of circular capes, carefully arranged, with the women. Again, in Kashmir, the abundant precipitation and consequent forests have led the people to build their houses largely of wood, with sloping roofs to shed the rain; beyond the mountains, on the other hand, the rarity of rain and consequently of timber has induced another type of architecture — one or two story houses of rough stones plastered with mud, and covered with flat roofs of mud, supported on beams and bushes.

At Matayan, the second village east of Zoji La, a friendly villager invited me to dive down from the crust which covered eight or ten feet of snow into a one-story house like that shown opposite page 48. We were still at an elevation of 10,500 feet, and had not wholly passed beyond the influence of the abundant precipitation of the Kashmir side of the mountains. Although it was the 11th of April, the snow, even on a level, was higher than the tops of the houses. Where it had been shoveled off the flat roofs, it formed high banks protecting them from wind, and making them the favorite sitting-room at that season, and even in winter;

for the sunshine is always warm in that dry, cloudless climate. When the little black cows had been driven and pulled out of the way, I descended to an almost closed shed used for the two or three hardy sheep and goats, and was ushered, stooping, into a dark stable containing a little pony, shaggy like all the animals. Bending low once more, I climbed over a high sill, and was in the warm, close, family living-room. Light and air came in through a hole in the roof a foot square, surmounted by a chimney-pot a foot high, made of three stones set up to keep out the snow. A few bits of ragged cloth on the mud floor for sleeping purposes, a half-dozen metal utensils, and an iron pot full of Himalayan tea, kept warm over some embers of dried dung, comprised all the visible equipment for housekeeping. After my host had persuaded me to take a seat on the floor, a half-palsied old woman insisted upon twice ladling out for me a bowl of tea. It was surprisingly good in view of the fact that a poor grade of leaves had been steeped half an hour or more with milk, butter, salt, and soda. In richer houses I was often served with tea which had been improved by being churned violently in a slender, greasy black churn, twenty inches long by four in diameter, in order to mix the rancid butter well into the compound before it was poured into the drinking-bowls.

As we sipped our tea, my host said that because of the unusually stormy winter, the snow, which was then nearly twelve feet deep, would not melt till June, two weeks later than the regular time. He went on to say that the earth, which we had seen scattered over many acres of the deep snow, had been dug up in the fall, stored in the stables and

houses all winter, and had now been spread over the fields to hasten the melting of the snow.

Although our friendly entertainers were Kashmiris, who, with their neighbors, had been brought across the mountains fifty years before by the government in order to keep the road to Ladakh open in winter, they had adopted the habits peculiar to their new environment. It may have been imagination on my part, but it seemed as if, under the influence of the more bracing climate, steadier work, and greater necessity for forethought demanded by the harder conditions of their new life, the people of Matayan had become franker, more hospitable, and less suspicious than their relatives in Kashmir.

Matayan lies in the upper part of the valley of the Dras River, in the midst of magnificent mountain scenery. The bottom of the valley is broad and flat and easy to traverse, while the sides rise precipitously 500 or 1000 feet to a shoulder above which peak after peak rises white and gleaming to a height of 17,000 or 18,000 feet. When we passed that way, everything was white except where the snow had slid in avalanches from some dark precipice of naked rock. No trees broke the pure expanse; the villages and the fields where earth had been scattered were but insignificant spots in a vast world of snow. Even at a distance of a few hundred yards, the trail that we were to follow was lost in the universal snow, which sparkled and scorched our faces in the sun, or lay cold and quiet in the blue shadows. Once some specks appeared far ahead, which, when we met them, proved to be three stooping boys, carrying on their backs huge loads of asafœtida cut in the

fall and dried for the sheep and goats. Long ago, a vanished glacier ground its way slowly down from the mountains, cutting off projecting spurs, smoothing and broadening the valley-floor, steepening the walls, and changing the valley from a gorge with a V-shaped cross-section to a typical glacial trough, U-shaped, with well-marked shoulders at the top of the U.

A few miles farther downstream, at the point where the old glacier came to an end, the trough changed suddenly to a gorge, and we found that our U became a V. The road ceased to follow the broad valley-floor near the river, for there was no room beside the water. The stream flowed between the steep cliffs of narrow terraces of gravel, like those of Kashmir, which filled the bottom of the V. Along these we made our way, finding the path level and easy except where it crossed the narrow gullies of frequent tributary torrents. At Karbu we found the terraces pitted with numerous tunnels, dug for gold which is contained in the gravel. There we met an English engineer prospecting for a mining company. He was disgusted with the meagre quantity of gold; it was not worth looking at, he said. He had found just one thing that interested him—a fragment of good gold ore said to have come from a mine near Lhassa owned by Buddhist lamas. The engineer was going home to tell his company that Tibet was the place to hunt for gold.

The terraces furnish not only the one source of mineral wealth in this poor region, but the only level land available for agriculture. Though they are extremely narrow and rocky, fields and hamlets are located upon them wherever water is available for irrigation. The difficulty expe-

rienced in bringing water to the places where it is wanted is enormous. At Hardus, for instance, on the Dras River near the mouth of the Suru, we saw that a mountain stream had been diverted into a little canal and carried along the precipitous side of the valley for three or four miles at a height of over a thousand feet above the river. Far below, in some characteristically rocky fields, irrigated from another canal, women with baskets slung on their backs were laboriously gathering the stones which had worked up during the winter.

The glacial features of the upper part of the valley and the terraces of the middle both appear to owe their origin to the great series of climatic changes of which we have already found evidence in Kashmir. It is difficult to assign any date to the later changes on the basis of local evidence. The general freedom of the fronts of the glaciers among the lofty mountains from large amounts of detritus and the withdrawal of some of them from their moraines show that the glaciers are on the whole diminishing in size; this suggests that the climate is becoming warmer or drier. Workman, however, mentions the case of one glacier which has recently advanced, though the advance may be only temporary. He also mentions finding large trees lying dead at a height greater than that where even stunted trees now grow. Probably the trees are relics of the dry epoch during the first half of the Christian era, but this has not been proved. West of the pass of Fotu La, I later saw, at an elevation of 12,400 feet, the ruins of a village which was said to have been abandoned a few years ago because its springs dried up — another suggestion of change of climate. The

reported cause of the abandonment of other villages in the same vicinity is that the streams have undermined and largely removed the terraces on which the fields were located.

At Kurgil, where the Suru River joins the Dras, we reached the first large village of Ladakh. Tibet seemed very near. In fact, we were already in Little Tibet, and our men always spoke of this, their own country, as Tibet, while they called Tibet itself, Lhassa. Thus far, the people whom we had met had been Mohammedans like our servants, but now we began to meet Buddhists with greasy pig-tails and big turquoise-studded earrings. When I met the first of them, I suddenly remembered a book on Ladakh which I had read years ago, and I saw again the mental pictures of Buddhist sculptures, monasteries, and prayer wheels that I had formed as a boy. Nor were they far wrong.

We had left the abundant snow of the Kashmir region, and were in a region of slight precipitation. Although Kurgil lies at an elevation of 9000 feet, the snow had almost disappeared on April 17th, and the field where I watched a primitive game of native polo that afternoon was almost dry. Not one part in a hundred of this rugged country can be cultivated. As one looks abroad, nothing can be seen but jagged white peaks and deep, narrow gorges of naked rock, dull and slate-colored most often, but sometimes of the pale gray of granite, or tinged with red, brown, and purple.

From the appearance of the map, we had supposed that our road from Kurgil would follow the Dras River ten miles farther to the northeast to its junction with the Indus, and then would go southeast up that stream to Leh. As a mat-

ter of fact, the valleys of both rivers here take the form of narrow gorges, which can be traversed only with the greatest difficulty. Hence at Kurgil the road turns to the southeast, leaving the larger valleys, and for forty miles lies almost parallel to the Indus, keeping ten or twelve miles away, above the heads of the short tributary gorges, and crossing two easy passes over 13,000 feet high. Apparently, the deep, narrow character of the lower reaches of the Dras, Indus, and other rivers indicates that the Himalayan region, as a whole, has been recently uplifted in such a way as to accelerate the main river and cause it to carve a deep canyon. Naturally the tributaries have followed suit, much to our inconvenience, and have converted the lower parts of their valleys into narrow gorges, although the process of deepening has not yet had time to reach the upper parts. Thus the warping of the earth's crust and the last phase of the uplifting of the Himalayas, though they took place long before the earliest recorded human occupation of the country, have had a very recognizable effect upon man. The process has not only raised the upper Indus valley to a greater elevation and intensified its Alpine character, but it has increased the isolation of the country. It has made the main passes higher, more snowy, and more difficult to cross; and has obliged every traveler to Ladakh to traverse two minor passes, instead of going down the Dras and up the Indus. The Dras River is typical of Ladakh. The Indus and most of its tributaries have three distinct parts like the Dras, — at the head a broad, glacial valley, smooth and easy to traverse, but cold and almost uninhabitable; in the middle a narrower valley, rendered habitable by its lower altitude and

by the terraces which occupy the bottom; and at the lower end a deep, impassable gorge. Sometimes there is no relatively habitable middle part of a valley; and a U-shaped glacial trough gives place abruptly to a V-shaped canyon. Nevertheless, the threefold division and its appropriate response in the habits of organic beings give the essential features of the geography of Ladakh.

Arid, inhospitable, and rugged as Ladakh may be, its clear air, bracing climate, and splendid scenery make the traveler long to return to it. The stony villages and ugly people have a peculiar charm. After leaving the Mohammedan villages in the vicinity of Zoji La and Kurgil, we had our first glimpse of the genuine Buddhist Ladakh at the hamlet of Maulbeck. A winding climb of several hundred feet up a massive tooth of limestone brought us to a lamasery, two whitewashed buildings with bands of red around the top, prominent landmarks, perched on a lofty pinnacle above the broadened upper part of a bleak open valley, surrounded by snowy mountains. Two of the lamas, or monks, clothed in the regulation gowns, caps, and boots, all of purplish red, received us. One, a young man of twenty, led us into the dark room which served as a temple. The other, the head lama, a little, beardless old man, with a most bland and innocent expression, showed us his own small room, which appeared to be the real sanctuary. Our guide from the village, a young man wearing a greasy pig-tail and a long gray gown of wool, prostrated himself on his knees before the door, and touched his forehead to the ground repeatedly. We were not invited to enter. As we gazed in through the door, the room appeared

to be a curiosity shop. Brilliant masks, gaudy banners, and colored streamers bearing printed prayers hung from the walls and ceiling; a row of shelves contained the holy Buddhist books, oblong packages of long, narrow leaves wrapped in cloth or leather; small, shining brass bowls full of water stood on boxes on the floor; and among them a huge salver of oil, said to be replenished once a year, bore on its surface an ever-burning wick. The room was regarded with distinctly more veneration than any of the holy places which I later saw in other, larger lamaseries, and the little lama's reverent attitude made us honor it. When I asked the use of a thin, drum-like object hung vertically from the ceiling, the lama smiled like a pleased child. Seating himself before it, he took a sickle-shaped drumstick in his left hand and a cymbal in his right, and illustrated the call to prayer. The childlike simplicity of the two inmates, especially of the old man, impressed me greatly, as did also the cleanness of the monastery. The other two or three lamas, one of whom we had met trudging down the valley, were away on the tours of begging by which the institution is partly supported.

Later, I visited other lamaseries, including Himis, the largest, but the impression was by no means so pleasant. The walls and ceilings of the sacred rooms were crowded with inartistic and sometimes vulgar paintings; countless images of Buddha and of saints stood in rows with offerings set before them in the shape of little round bowls of oil supporting burning wicks, or of conventional flowers and symbolic forms modeled in dough; and the open spaces in the middle of the room were filled sometimes with

dusty benches, mere planks six inches above the ground, on which the lamas sit to read the holy books. In general there was an appearance of dust and untidiness. Some of the lamas seemed to be men of ability, and all were friendly, but the majority appeared coarse, lazy, avaricious, and sensual. In spite of previous reading as to the resemblance between Buddhism and the Roman Catholic form of Christianity as it is seen in the less enlightened countries of Europe, I was surprised at the closeness of that resemblance. It appeared not only in the monastic system, well known to be almost identical, but in the form of worship, the lights, the images and pictures, the intricate ritual, the absolute dependence of the people upon the priests, the reliance of the latter upon spectacular effects, and the faith of all in charms and set forms of prayers.

It is difficult to say whether the Ladakhi is superstitious because of his religion, or whether his religion is superstitious because of something in his environment. Certain it is that few people are more superstitious, or make their superstition more evident in their religion. In addition to the frequent lamaseries, we found in almost every village scores of "chortans," pagoda-shaped structures of mud and stones, erected partly as receptacles for the ashes of the dead, and partly as works of religious merit. The approaches to villages were marked by "manis," which the Buddhist religiously passes on the left, so that his right hand may always be toward them. They were long heaps of rubble, shaped like sheds, with a width of twenty feet, a height of five or six, and a length of from fifty to a thousand. Each "mani" was covered with hundreds of flat

stones, eight or ten inches in diameter, on every one of which the lamas, "for value received," had inscribed the universal prayer, "Om mani padme hum," often interpreted as "Oh, the jewel of the lotus." The number of repetitions of this prayer determines the amount of credit which the worshiper of Buddha lays up for himself in heaven. In the lamaseries the lamas write it on pieces of paper, which are put in hollow wooden cylinders about a foot high and eight inches in diameter. The cylinders are set up in long rows on the outside of a building at a height of three or four feet above the ground, and are mounted so that they revolve easily on vertical axes. Visitors to the lamaseries as well as the lamas themselves take occasion to walk past the rows of cylinders and to strike each one with the right hand in such a way as to cause it to revolve. Each revolution gives the worshiper as much credit as if he had himself said, "Om mani padme hum." The lamas often carry little hand cylinders full of prayers, which they swing round and round instead of telling their beads.

Every house has its prayer-inscribed streamers of cloth fluttering from poles on the roof, to keep off demons; and every man, woman, and child is said to wear a charm for the same purpose. Streamers are used to cure all varieties of trouble. At Leh we were shown one set up on a pole a few months before to prevent the demon of the cattle plague from killing the yaks and oxen. The people confessed their regret that it had proved a much less effective preventive than had the drastic measures employed in certain valleys where all ingress and egress, whether of man or beast, had been strictly forbidden.

The intensity of the Ladakh's superstition may perhaps be connected with the impenetrability of his great mountains, fit homes for millions of demons, and with the suddenness of the disasters which overtake him. On a clear day, a storm may gather on one of the snowy passes and in an hour or two overwhelm a whole caravan. Under the influence of a mild drizzle or of a bit of melting snow, the soil may be loosened so that avalanches of rock suddenly sweep down the steep mountain sides to block the roads, kill travelers, and bury villages. At other times, as happened at Leh a few years ago, a flood of accumulated snow-water may burst out of an apparently dry valley, and destroy houses, fields, and villages. When he sees so many evidences of what he supposes to be the activity of demons, small wonder that the Ladakhi becomes nervous, and thinks it wise to save his crops from drought and frost by hiring a red lama to sit beside his field while it is being sown, and read all day from a leaf of the holy book. And it is equally wise to keep demons out of the house by smearing the lintels, doorposts, and corners with blood or red paint, a custom curiously suggestive of that of the ancient Israelites.

In spite of his fears, the Ladakhi is famous for his good humor, partly, perhaps, because of the clearness and invigorating quality of the mountain air, which undeniably tends to put the traveler in high spirits. I had an illustration of the good temper of the Ladakhis during a two weeks' trip from Leh to Lake Pangong, sixty miles to the east, on the border of Tibet. On the way it was necessary to use coolies in crossing the pass of Chang La, 18,400 feet high, over the most remote and lofty of the three ranges of the

Himalayas. On arriving toward sunset at Sukti, the last village on the southwest side of the mountains, I told the "lumbadar," or headman, that I wanted seven coolies to be ready to start at two in the morning, so that we might reach the pass before the snow began to grow soft in the hot May sun, and so get over in a single day. Although at nine o'clock, when I went to bed, nothing appeared to have been done, at about eleven a crowd of men filed into the room, headed by the lumbadar. The pass was very bad, they said in Ladakhi, which Ibrahim, my Mohammedan servant from Leh, interpreted for me into Turki. To go over to-morrow was impossible. All the men in the village were willing to go, but they were not ready. Would I not take two days to go over? — putting their hands together, and bending low in supplication. Their shoes were bad, and must be mended, and they must get new strips of cloth in which to wrap their legs. Here they all showed their ragged garments and foot-gear. Would I not delay the start till daybreak to-morrow? — bending again in supplication. They did not want pay. Five men would go for the wages of one. The result was that we took two days for the pass. If the breathless climb and labored descent through the snow made the coolies as weary as it did me, their supplication is not to be wondered at. When they turned back, Ibrahim, by a mistake, afterward rectified, paid them only twelve cents apiece instead of twenty-two. They accepted it without complaint, and said, "Ju! ju!" the usual Ladakhi greeting, as if most grateful.

On returning across the pass, May 13, my six young Ladakhi coolies were even more cheerful, and acted as col-

lege boys might in America. Going up the pass they sang a little, but a temperature of eight degrees Fahrenheit at half past six in the morning, and a steep ascent through snow, made it necessary to attend strictly to business. Coming down, however, they sang vigorously and musically for hours, sometimes all together, and sometimes one alone, the others joining in the chorus. From the laughter and gestures it appeared that they often inserted sentiments about one another. In the intervals of singing they cracked jokes, and did "stunts" in the way of running down steep places with their loads, conduct utterly different from that of the sober professional coolies whom we had employed a month before in Kashmir.

Another incident illustrating Ladakhi character occurred one noon when we reached the village of Ibrahim's parents-in-law. Nothing would do but that I must go in and have a cup of tea. So in I went, by a devious way, through the stable and up some stone stairs to the second story and the large living-room, low and smoky. Sooty cobwebs hung in festoons from the shining black rafters of the flat roof, smoke-blackened heads of barley were tied as ornaments, or as votive offerings, about the capitals of the wooden pillars, and two long shelves supported a row of black pots and pewter plates. The glory of the house was the mud oven about two feet high, with several openings for pots. Its sides were neatly adorned with clay bas-reliefs of flowers. The chief defect was the absence of an effective chimney. An entire goat-skin, open only at the neck, served as a bellows. I was given the seat of honor on the floor in a corner, where a little mattress, hard, thin, and square, was placed for my

benefit. I carefully moved it to an uncomfortable place near the smoking stove. I did not enjoy the heat, nor the smell of cooking fat, but my head was close to the single small hole in the wall, through which a mild gust of wind occasionally thinned the smoke. "Talkan," or parched flour, stirred into a paste with Himalayan tea, sugar, and plenty of melted butter, was placed before me, and was followed by a bowl of salt tea, flat cakes of bread, and fried eggs, the latter most unsavory in appearance, but not unappetizing. The visit seemed to give real pleasure to the household. Whenever I looked at the wrinkled little mother-in-law, she made a half curtsey, jerked her hand to her forehead, and smilingly said, "Ju!" In spite of being a Mohammedan, the only one in the village, she was unveiled, and went about freely among the men like the Buddhist women.

The position of women among the Ladakhis, as among the Tibetans, of whom, it will be remembered, they are a branch, is peculiar because of the practice of polyandry. This custom, like the prevalence of monasticism, as several writers have pointed out, is probably due chiefly to the limited amount of land available for cultivation, and to the consequent necessity of restricting population. If two brothers from a family of three have a single wife, and if the other becomes a lama, the entire family heritage of fields can be kept undivided, and a single house will serve for the whole family. But the question at once arises, What becomes of the daughters for whom there can be no husbands under such a system? There do not seem to be any. For some unexplained reason, girls appear to be less

numerous than boys, as I was told by Dr. Shawe, an English physician, who has lived for years in Leh as a missionary. He knew of no cause, such as female infanticide, which could account for the anomaly.

Geographically, the institution of polyandry is most interesting as a unique response to straitened physical conditions. In Ladakh the means of supporting life are scanty, and there is no opportunity to increase the amount of cultivated land, or the number of flocks. In most such lands the population increases until the pinch of want is felt, whereupon emigration ensues. In Ladakh the growth of population has been limited by the two peculiar institutions of polyandry and monasticism. Hence in a region where we should expect frequent movement of part of the inhabitants, there is the opposite condition of great fixity. Objectionable as both polyandry and monasticism are to modern western ideas, some method of limiting population seems to be a necessity in a land where opportunities are so restricted, and migration to unoccupied lands is so difficult. In Baltistan, just west of Ladakh, where physical conditions are similar, these institutions were overthrown some centuries ago by the introduction of Mohammedanism. Hence the people are constantly becoming too numerous, and the poorer ones are compelled to migrate to the most unproductive, and therefore heretofore unoccupied, corners of the regions round about them.

The dress and houses of the Ladakhis, their manner of life, and their more obvious habits have been often described. The connection of all these things with physical

environment is generally easy to trace. Perhaps the most noteworthy fact in regard to the people is that their characteristic traits of comparative honesty, courage in spite of superstition, industry, intense love of home, and cheerfulness under difficulty, are those which, all over the world, seem to make mountaineers, of whatever race, better men than the inhabitants of plains, where life is easy.

CHAPTER III

LAKE PANGONG AND THE KARAKORUM PLATEAU

NORTH of Ladakh a vast desert stretches for two hundred miles to the borders of Chinese Turkestan. It is not a desert of sand and heat and plains, but of snow and cold and mountains. On the north and south respectively it is bordered by yet higher mountains, the magnificent ranges of Himalaya, the "Abode of Snow," and of Kwen Lun, still more inaccessible. In both, the loftier peaks tower to heights of 25,000 feet, and the main passes are 15,000 feet or more above the sea. Between the ranges the mountainous plateau of Karakorum or "Black Gravel," at an altitude of 16,000 to 18,000 feet, forms the main portion of the bleak desert, the dread of caravans. It is not surprising that India and western China, with such a desert between them, have little communication.

My acquaintance with this region began with an excursion of two weeks from Leh eastward over the main range of the Himalayas to the salt lake of Pangong, 14,000 feet above the sea, — an excursion which was described in part in the last chapter. Later, with Mr. Barrett, I spent thirty-five days, from May 15 to June 18, in crossing the main plateau and the bordering ranges from Leh, south of the highest range of the Himalayas, to Sanju in Chinese Turkestan, north of the Kwen Lun range. After traversing the main plateau, we attempted to shorten our journey by crossing the unexplored pass of Hindu Tash in the Kwen

Luns, and thus going direct to Khotan. Storms and snow compelled us to turn back and make a détour of a hundred miles to the west, to the easier and lower pass of Sanju, 16,700 feet high.

On the way to Lake Pangong, I went up the Indus valley a day's journey from Leh, and crossed on foot to the north, over the pass of Chang La in the main range, with my cheerful Ladakhi coolies. Near Durgukh, at the northern base of the pass, I left the main road, which we later followed on our way to Turkestan, and turned to the east up the valley which carried the drainage of Lake Pangong before that sheet of water contracted to its present size and ceased to overflow. At Durgukh, an official order from Leh enabled me to hire ponies for the ride of thirty miles to the lake. They were shaggy, unkempt little animals, and were cared for by two equally unkempt Ladakhi youths, quiet, cheerful, and willing. I could not make my horse hurry at first, for when I said, "Clck," he stopped as though shot, nearly throwing me over his head. It was only when I learned to say, "Choo! choo!" that I could persuade him to hasten a little. Downstream from Durgukh the valley turns to the north, and enters a narrow V-shaped gorge, almost impassable, as we found later. Upstream, however, we encountered very easy traveling, for the valley has been glaciated, and its broad U-shaped trough forms an easy approach to Pangong.

The lake is a sparkling sheet of the clearest, deepest blue, shading delicately to purple in the shadows, and to pure pearly green in the shallow rim near shore. Dark rugged mountains spring steeply one or two thousand feet

from the winding shores of smiling blue bays, and then, at gentler angles, rise four or five thousand feet more to snow-capped peaks separated by glacier tongues. All is silent save for the cry of a waterfowl, or the lapping of the waves. The barren mountains, with their dull tints of gray, purple, red, and brown, stand in all the naked grandeur of the earth's solid crust of rock. There is no vegetation or settlement worthy of mention, nothing to soften the severity of the clear-cut scenery into the gentler, milder beauty of more favored lands. Yet even so, the beauty of Pangong rivals that of the most famous lakes of Switzerland or Italy.

Elsewhere I have discussed at length some of the scientific problems connected with Pangong.[1] Here I shall only speak briefly of two, namely, the origin of the lake, and the climatic changes to which it bears record. I shall merely state the results of my investigations, without attempting to cite the evidence. Pangong is the lowest of a series of five lakes, lying at nearly the same altitude, and separated only by deltas two or three miles wide, like that at Interlaken in Switzerland. The five are really one, which has been divided into parts by the deposits of tributary streams. They occupy what appears to be part of an ancient winding river valley. The lakes and deltas together have a length of a hundred and five miles, a maximum breadth of four miles, and an average breadth of only two. The relation of length to breadth is about the same as that of the length of this page, from top to bottom, to the height of the larger letters in this line. In scenery and shape, and

[1] *Journal of Geology*, vol. xiv, 1906, pp. 599–617.

apparently in origin also, the valley lakes of the Pangong series are of the same type as the famous lakes of Switzerland, the lochs of Scotland, and the fiords of Norway. Many geologists believe that such lakes and fiords are due to the work of glaciers. The streams of ice are supposed to deepen and broaden certain parts of their channels more rapidly than other parts. Thus relative depressions are formed, which are converted into lakes when the ice retires. Other geologists hold that this is impossible; for, if it were so, there surely would be similar lakes among the intensely glaciated regions of the Himalayas. The discovery there that one such lake lies in a valley formerly occupied by a huge glacier detracts from the force of the objection. Apparently, the number is not larger because, as I saw in the Shyok valley and one or two other cases, most of the streams flow at right angles to the mountains, and have such steep grades that, in spite of the deep erosion of the glaciers, the streams have been able with equal rapidity to cut gorges through the relative elevations in the valley bottoms, which would otherwise cause lakes to accumulate above them. The Pangong valley, on the other hand, runs parallel to the mountain ranges, and has a gentle grade, so that the cutting power of its stream has always been less than that of the transverse streams.

The most important geographic feature of Pangong, so far as human relations are concerned, is the evidence which it affords of recent climatic changes. Old beaches and lake deposits indicate that after the great changes in climate which gave rise to the glaciers that scoured out the basin now occupied by the lakes, there were other changes

of the same type, but of less intensity. The varying amount of precipitation, or of evaporation, caused the lakes to alternately expand and contract. In Pangong itself, the highest beaches indicate that the lake expanded to a level two hundred feet above that of to-day. It then contracted, as the deposits show, and again expanded to a sixty foot level marked by lower beaches. Numerous smaller strands and desposits show that minor oscillations of the lake level, caused apparently by minor changes of climate, were superposed upon the larger oscillations. As all these changes of lake level took place after the severer epochs of the glacial period had passed away, they must have come within the time of man, and the later ones probably within the years covered by history. Hence their study is of importance not only for itself, but in relation to the problem of the influence of climate upon history. Apparently, the change from fluvial conditions of lake expansion to interfluvial conditions of lake contraction was characterized by great irregularity in the form of acclerations and reversals of various degrees. If the climate of Pangong from prehistoric times down to the present be represented by a curve descending from a state of severe cold and heavy precipitation to one of comparative warmth and aridity, the descent must not be pictured as regular, but as broken by many minor curves both up and down. Climate, to judge from Pangong, is, and long has been, a more changeable element than is commonly supposed.

On returning to Leh from Lake Pangong, I found that Mr. Barrett had equipped a caravan of fifteen unusually good ponies and five mules. He had also engaged another

man, in addition to the five excellent Mohammedan Ladakhis who had accompanied us from Kashmir. The new man was a strapping, good-humored, pig-tailed young Tibetan, who, according to the fashion of his people, politely stuck out his tongue whenever we looked at him. The shortest route to the north, via the passes of Kardong and Saser, was out of the question so early in the season, because of snow, but there was a chance that we might be able to get the ponies over the more easterly pass of Chang La, which I had just crossed twice on foot. Then we could travel to the north up the Shyok valley, instead of eastward to Pangong, as I had gone. The croakers of Leh said that no ponies could get through the snow on Chang La, and if they did, it would be of no use, for the many fords of the Shyok River would stop us anyhow. Mr. Barrett, however, decided to take the chances. On the 15th of May, a month before the time for the opening of ordinary caravan traffic, we started eastward up the Indus on our way to Karakorum and Turkestan far to the north.

When we reached Chang La, 18,400 feet high, on the third day, the croakers were almost justified. The ascent was not especially difficult, as we started at night when there was a stiff crust on the snow. On the farther side the coolies made good progress, although the new snow, which had fallen to a depth of eight or ten inches on the old crust since last I crossed, became soft almost as soon as the sun rose. The animals, however, even though none of them carried loads, broke through, and floundered and struggled pitifully, scarcely able to draw their bleeding legs out of the deep holes in the icy crust. By the time we

had descended four hundred feet, they began to appear exhausted. One mule was already far behind, able to move only with the help of two men. Although it was only ten o'clock, we decided to stop where we were, on a little hill-top with a few rocks projecting through the snow. The prospect of camping there at an elevation of 18,000 feet did not seem at all bad in the hot sun between ten and twelve o'clock. We hoped that at night the snow would freeze stiff enough to support the animals. As we had been working hard since near midnight, every one went comfortably to sleep; but we had forgotten the west wind. About noon it began to blow, gently at first, merely wakening us by whirling snow into our faces; but in an hour a gale was raging, chilling us to the bone, though the sun was shining brightly. It filled the air so full of blinding dry snow that we could sometimes scarcely find one another. Wrapped in sheep-skins, and with woolen cloths tied over our heads, we and our escort were fairly comfortable, but the poor coolies and horses were shivering unprotected in the open, and a few hours of such a wind might kill them. It was absolutely necessary to go on, even if some of the horses died from over-exertion in such rarefied air. Poor brutes, how they plunged and fell, and lay panting and exhausted, and then with splendid spirit, heaved their cut legs out of the crusty snow, and struggled on, to fall scores of times, but never to yield. Only the mules, Lhassa-born though they were, seemed to lose all spirit. Time and again one or another stretched out its legs, and laid its head on the snow as though to die. Each time our plucky men got it up, rolling it over upon its legs, and almost lifting it

bodily upon them by pulling its head and tail. Often a poor beast plunged its legs inextricably into the snow, whereupon the men dug them out one by one, pulled them out by hand, or even dragged them out with ropes. By sunset the exhausted men and animals had all descended a thousand feet more to a miserable camp at an elevation of 17,000 feet, where the snow was only a foot or two deep. No one seemed to suffer from a temperature of minus two degrees Fahrenheit the next morning, May 19. As we had plenty of grain for the animals, and food for the men, every one was ready for work. We all reached Durgukh in safety. When the fifty or sixty coolies were paid off, Mr. Barrett gave generous presents to those who had worked hard. Thereupon it appeared that even the patient, cheerful Ladakhi has socialistic tendencies, and appeals to mob violence on occasions. When those who had received only the regular wages found that their complaints were in vain, they combined to take away the extra money from the more fortunate ones by force, and after a wordy fight with some blows, divided it equally among all.

The fords of the Shyok River, to which we had been looking forward with such anxiety, proved much easier than Chang La. We spent the eight days from May 22 to May 29 in traveling northward up the steep-sided, broad-bottomed glacial valley, crossing the river twenty-seven times, and once making our horses wade half a mile in the stream, all without the least difficulty. The reason for the half mile in the river was that just before turning up a tributary canyon to the Depsang plain, we found the whole valley bottom covered with a sheet of ice. As its bed became

gradually choked with ice at the beginning of the previous winter, the stream had overflowed and frozen in a huge sheet. In melting, the edge of the ice broke off in a little cliff from three to five feet high, which the horses dared not attempt; so the only open path was in the water.

We had no difficulty with the fords because the weather for a few weeks previous had been unusually cloudy, so that but little snow had melted. Among the lofty mountains of the arid regions of Central Asia, as we saw and were told again and again, floods are rarely or never due to the influence of rain upon melting snow, as so often happens with us in America and Europe, but rather to the rapid melting of the snow under the powerful rays of the unveiled summer sun. The rain among lofty mountains, as is well known, is usually a cold drizzle with little melting power; while the sun, shining undimmed through the clear thin air, is extraordinarily hot. May 28 was a cloudy day, and a little wet snow fell in the evening. We pitched our camp that night on the right side of the Shyok River, a clear, rushing stream thirty feet wide and a foot deep. In the morning, we traveled diagonally across the cobble-strewn flood-plain, here about half a mile wide. It was seamed with numerous dry channels. Some time after we had come to the farther side, it suddenly occurred to me that we had not crossed the river. I waited till Mr. Barrett came up, and asked: —

"Have you crossed the river this morning?"

He could not remember having done so, and neither could the men. We looked again, but there was no river. Yet even as we were talking about it, a new stream came foaming down a dry channel, a red muddy flood of freshly melted

snow. During the preceding cloudy day, so little snow had melted that the river had completely dried up. This morning, an unusually hot sun had melted the fresh snow of the preceding night so rapidly that before eleven o'clock the river had revived.

A month later, on the northern slope of the Kwen Lun mountains, I proposed to take a guide and a servant, and go down the gorge of the Sanju River, where the fords are very bad. The guide said that it would be possible if the cool, cloudy weather continued, but not if it were clear and sunny. It rained the evening before we started, but that neither caused the river to rise, nor disturbed the guide. The next day, however, it was warm and clear. The guide became nervous, urging us to gallop down the valley whenever possible, in order to cross the last ford before the daily flood from the high snowy mountains overtook us. We outstripped the river, but had not been long in camp when a boy called out:—

"The flood has come."

Sure enough, the river had suddenly become muddy, and was visibly rising and broadening into an impassable torrent. Similarly in August, on the upper Chira River, a week of rain, mostly drizzle, did not cause the stream to rise so much as did a single day of bright sun. Farther east, near Lop-Nor on the same northern slope of the Kwen Lun range, I was told that in summer the erratic Vash Sheri River becomes a mere brook during periods of three or four days of cloudy, rainy weather among the mountains, but expands to a violent flood when, for a few days, sunny weather melts the snow. Various writers have noticed simi-

lar phenomena. For instance, Church, speaking of the Akjas River in the eastern Tian Shan plateau, says in a matter-of-fact way: —

"I don't know how they cross it when the snow is melting in spring, but suppose that then the old plan of waiting for a few cloudy days has to be adopted."

The significance of all this for our present purpose lies in the fact that increased cloudiness, however caused, preserves ice and snow. It also prevents evaporation. If Asia, for instance, should, as a whole, become more cloudy, the result would be a series of phenomena practically identical with those which characterize fluvial epochs; and also practically identical with those which would ensue if the temperature of the country were lowered, or if the amount of rain and snow became larger. The size of glaciers would increase; the volume of springs and rivers would be larger and more uniform; lakes which have no outlet would expand; the soil would everywhere be moister; and vegetation would flourish in places which are now desert. We do not yet know whether fluvial epochs are due to greater cloudiness, heavier precipitation, or lower temperature — probably to all three. The question is of especial interest because of the diverse influence which changes of the three kinds would probably have upon the occupations and hence upon the history of man. We shall come to it again in another connection.

The main features of the bottom of the Shyok valley, in addition to the rough flood-plain, are terraces of gravel and talus, covered with fans whose fronts have been nipped off by the river. Behind them tower splendid cliffs, one or

two thousand feet high, shutting out most of the gentler slopes lying above. The scenery was magnificent, but we wearied of limitations. We longed to see the upper parts of the narrow tributary valleys, which hung on the sides of the main valley and poured forth huge fans and cones of angular gravel from their mouths, high above the flood-plain of the main stream. We were also eager to investigate the glaciers, whose gleaming fronts, unhidden by moraines, peered out from lofty hanging valleys, and the high peaks which, according to the map, rise 25,000 feet above the sea. We could not understand the origin and history of the mountains without a view of their upper parts.

Starting at 4 A. M. on the 27th of May from a height of 13,800 feet, I rode up the steep talus slope of an old moraine to an elevation of 16,000 feet, where the ponies had to be sent back. Then, from six o'clock till noon, I toiled on alone over sliding talus slopes, struggled through soft snow up to the hips, or climbed with hands and feet up slopes of naked rock. I had chosen the mountain illustrated opposite page 76, because from the valley it appeared comparatively easy to ascend, but at noon, though I had reached a height of 20,500 feet, a white slope of snow of a thousand or more feet still rose steeply ahead. To go on, alone as I was, would have been folly, for it had taken a full hour to climb the last three hundred feet, and the mixture of smooth cliffs and soft snow ahead looked even worse than what I had already surmounted. I was tempted to think that I was exhausted and cold, and had a headache from the exertion and altitude, but a seat in a warm, sunny nook, and the sound of a little bird singing

there four miles above the sea, drove away the thought of discomfort.

From the top of the pass of Chang La, ten days before, I had looked to the southwest across the Indus valley to the middle range of the Himalayas, and had been impressed by the evenness of the sky-line brought out in the accompanying photograph. At an earlier date, when looking northward from the lamasery of Himis, I had noted the same feature in the main range to the northwest of Chang La. Now, from my nameless mountain, the view seemed, at first sight, to be of a different nature. It was characterized by sharp, freshly-cut forms. Closer examination, however, showed that there were three kinds of slopes. The youngest were the steep valley sides due to glaciation, and rising two or three thousand feet above the streams. Above them, and often merging into or undercut by them, there were less precipitous, but, nevertheless, very steep young slopes due to the ordinary non-glacial processes of erosion. Higher yet, the mountain tops, for the most part, were characterized by gentler slopes and occasional smooth crests. Some of these appear in one of the illustrations of this chapter. If the gentler slopes are reconstructed, a subdued mountainous country is produced, with a topography like that of New England, old mountains with gentle slopes rising sometimes into "Monadnocks" four or five thousand feet above the general level.

Farther north, we found that the deep young inner gorge of the Shyok River grows shallower, and finally merges into the upland plain of Depsang near the centre of the Karakorum plateau. The topography of Depsang is of the same

gently rolling sort as that which has just been described, as is apparent from the illustrations. The character of the scenery remains the same for nearly a hundred miles to the north, to the border of the Kwen Lun range. There again the rivers begin to flow once more in steep-sided young gorges, and cut across the range itself in canyons of wonderful depth and grandeur. The mountains are sharply dissected into magnificent peaks and arêtes, but at some places, as is shown in the photographs, traces of what seems to be an older, gentler topography can be detected.

Apparently, during recent geological times, the whole Karakorum region and its borders, from India on the south to Turkestan on the north, stood at a much lower level than now. The mountains, instead of being like the present Himalayas, were low and mature, not unlike the Appalachians. Later, the whole region seems to have been uplifted in a single mass, much as a continent rises slowly above the sea. Some parts, such as the border ranges of Himalaya and Kwen Lun, may have been raised more than others, forming broad, gentle arches, or elongated domes, measured in units of scores of miles. In such places the grade of the rivers must have been steepened. Hence the border ranges are much more dissected and furnish much finer scenery than the central regions. There seems to be little or nothing to indicate that individual ranges or peaks owe their form primarily to local movements of the earth's crust. The whole appearance of the country, and the uniformity of the types of mountain and valley on the two sides of the main plateau, seem to indicate that there has been a

single great uplift, with more or less buckling of the crust into long swells. The minor, albeit to the traveler the most impressive features, such as valley, ridge, and peak, appear to be wholly the product of aqueous, supplemented by glacial erosion. On every side of Chinese Turkestan, as appears from my own observations and those of others, the so-called mountains are in reality plateaus of comparatively slight relief except on the edges. Potentially, to be sure, they are mountainous, for they have the necessary elevation, and the typical contorted rock structure. In time they must be cut to pieces by rain and rivers, and must assume forms like those of the Alps, where few or no traces of a plateau can be detected. On the whole, the Karakorum plateau and the other plateaus of Central Asia strongly support the new geological view that the great mountain systems of the world originate as plateaus, that is, as uplifted blocks or arches of the earth's crust, which are raised up not as individual ranges, but as broad regions, to be carved later into the form to which we usually apply the name of mountains.

The descent from my mountain and the little bird was easy, as I slid on the snow for nearly two thousand five hundred feet. The bird was probably a migrant on the way to Turkestan. Henderson, the only ornithologist who has ever worked in the country, says that some of the most delicate of the birds of India, little warblers with the most wavering, uncertain flight, cross the cold plateau of Karakorum to spend the summer in Chinese Turkestan. It is marvelous that such seemingly impotent creatures should be able to cross two hundred miles of bleak desert amid

the cold winds and storms which so often prove fatal to man. Most of the way, the wee creatures must fly at an elevation of almost 20,000 feet, where one would suppose that they would be chilled to death at night, or that such extremely active little beings would perish for lack of air.

Back in the Shyok valley, we pursued our way northward. As we rose higher, the nights began to grow cold. On June 28, near the Depsang plain, at an elevation of nearly 17,000 feet, the temperature fell to eight degrees. Our men confused the effects of temperature and altitude. Knowing that in this region something often seems to be wrong with an animal's head, they supposed it must be due to the cold. Accordingly, they made for each mule a red or white triangle of cloth, and tied it below the ears so that it hung down between the eyes. As a precautionary measure for themselves, they wisely refrained from eating meat, and gave up their buttery tea. At Kuzzil Langer, May 31, where we camped at an elevation of over 16,500 feet, Ramazan, the cook, brought us some pieces of an especially esteemed kind of bread. It was a slightly sweet, thick, buttery cracker, not particularly healthful, but much prized by the home-loving Ladakhis, who always carry a supply of it with them to eat on special occasions, when they meet friends, or when, as they say, "they want to think of home, where the bread was made."

"Put this in your pocket to eat to-morrow," said Ramazan. "There is some kind of poison in the air here. You will be out of breath and feel sick, and you ought not to eat anything else. The Lhassa man," he added, referring to

Jum Yung, the Tibetan, who was in the habit of running and singing a great deal when he took care of the horses, "is already out of breath."

When I told Ramazan that the trouble with the air was not due to poison, but to the height of the pass, he could not understand how that was possible.

"This pass is not high," he said. "You will see when we come to it that the climb is short and gentle. Zoji La [the pass between Kashmir and Ladakh] is much higher, but there is nothing the matter with the air there."

I explained that we had been climbing gradually for many days, and were now at a great elevation.

"You have traveled far and read many books," he answered, only half convinced, "and I suppose you know; but when we have to climb hard to get to a pass, we call it high, and when the climb is easy, we call it low. So we think that Zoji La [11,400 feet] is high, and Karakorum [18,300 feet] low."

At this time, having left the canyon of Shyok and that of its tributary, the Murgo, we were among the broad open valleys and gently domed mountains of the central part of the plateau. Traveling would have been easy, if it had not been for the great altitude and the almost utter absence of vegetation. The horses suffered from hunger in spite of their generous rations of grain. The animals of any caravan not well equipped with grain become pitiably weak and die by scores. Along most of the route from Leh to the Sanju pass, carcases were so abundant that the vicinity of the road had become the haunt of the dismal carrion-eating crow, or raven. At least, when we left the road the ill-starred birds

became scarce, and when we returned to it they again became abundant.

On the first day after joining the main caravan road in this region, I counted the remains of thirty-two horses, half eaten by wolves and ravens. The following day, in eighteen miles I counted two hundred and twenty skeletons and carcases of animals that must have died within the last two or three years. We also passed, that day, thirty-six bales of tea, spices, cloth, and Korans, abandoned the previous fall by a caravan which started too late from Leh. Rasul, our headman, had heard all about it: one horse gave out here, two there, and three in another place; then a snow-storm came on, and the men fled for their lives, leaving the remaining loads, ropes and all, in the middle of the flood-plain of a stream. The owner expected to send a new caravan in a month or two to get the goods and carry them on to Yarkand. He knew that they would be safe, for such incidents are common. Custom, stronger than law, binds all travelers to respect the property thus temporarily left in the road. We camped at an elevation of 17,400 feet, near twelve of the bales, which our men used as a wind-break, unmindful of the carcases of four or five horses lying close at hand.

We had now reached the centre of the plateau. The next day, June 2, we crossed the Karakorum pass, 18,300 feet above the sea, the culminating point of the highest trade route in the world. In twenty-one miles I counted four hundred and seventy-four dead horses, not to mention numerous dismembered skeletons, thirty-two bales of merchandise, and one human corpse. His fellows had no time

or strength to bury him; they simply wound him in cloth, and laid him on the ground with his face toward Mecca. At the top of the pass our caravan halted, as its predecessors have done for ages. Our pious Mohammedan servants gathered around the roughly squared heap of stones which, though a hundred miles from the nearest habitation, marks the boundary between India and China, the two most populous countries of the globe. Each man took one of the round, flat Ladakhi home-cakes, broke it in two, laid half with a handful of dried apricots as an offering on the stones, and ate the other half with another handful of apricots. There was no fanaticism about it, simply reverent gratitude to Allah for bringing them safely to the top of the dreaded pass. Even the despised Buddhist and the half-tolerated Christian were invited to share in the offering, and in the short prayer which concluded with reverent stroking of the beard in memory of the Prophet.

A short distance beyond the pass, there were jolly shouts from the men as we came upon the last pair of the sixty-eight abandoned bales of the unfortunate caravan which preceded ours. They contained dates, very dry, but large and sweet. As one bag was open, each man took a handful. Rasul said to me in Turki:—

"We have crossed the pass in safety. Now Allah has given us something to make us glad. We had no tea this morning. Now he has given us dates. The 'kismet' [fortune] of the Sahibs is good."

That night snow began to fall; when the last man, who was supposed to have charge of the weakest animals, appeared at camp long after dark, two ponies were missing.

They were ahead with the rest of the caravan, so he thought. The next day, in the dazzling glare of six inches of new snow, the men found one of the animals, but the other with its load of food and clothes never appeared. Probably there were four hundred and seventy-five ponies dead on the road instead of four hundred and seventy-four.

For the next ten days the weather was bad, with snow almost every day. Rasul grew sober.

"I not seeing what for we having this bad weather," he remarked in his Kashmiri English. "We not opening that bag date. He making open when we coming. Every horse, dog, donkey could eating. This road's rule is every man taking all thing from bag when he finding open. That bag open heself. We not making. But this bad weather coming after we taking date. Perhaps Allah making very angry. I plenty wishing we not taking."

Our misfortunes were not serious. The worst was that we lost six days in a vain attempt to force a passage across the ice and snow of the unexplored Hindu Tash pass in the Kwen Lun range, leading directly to Nissa and Khotan. Between the Karakorum plateau and the Kwen Lun range lies the valley of the upper Karakash River, habitable for nomads, but not for people who practice agriculture. Here we found a few Khirghiz, who put their yaks at our disposal, and in every possible way helped us in our attempt to cross the Hindu Tash. Leaving the horses to follow us later if our attempt proved successful, we essayed the pass. The yaks, splendid strong creatures, which never stumbled and never hurried or grew nervous in the steepest, most precarious places, bore us up to a height of 17,000 feet. When

the snow grew deep, three of the best ranged themselves side by side, put their heads together, and pushed their way through the drifts like a great living snow-plow. It was of no use, however. The snow was too deep. We were obliged to retrace our steps, and go a hundred miles westward down the Karakash River to Sanju Dawan, 16,700 feet high, the last of the great passes on the usual route for caravans. Even this is by no means easy: the ascent on the south is tremendously steep; and the descent to the north, when we crossed, was slippery with ice. All our loads, as well as ourselves, were carried by grunting yaks, which ground their teeth most horribly. Even though relieved of its load, one mule could not climb the steep ascent, and had to be shot. The rest of the caravan crossed the pass without mishap, and we camped that night on the northern slope of the Kwen Luns in Chinese Turkestan. Some pilgrims from Mecca, who came over a day or two later and overtook us, followed the wrong path, and encountered bad ice. Four out of their eleven horses slipped, and, with their loads, fell one or two thousand feet to destruction.

Almost without exception, the caravans which cross the "ridge-pole of the earth," as the Karakorum plateau is sometimes called, suffer disasters from famine, storm, or mountain sickness. It is by no means rare for a caravan to lose a quarter or a half of its animals. Yet in spite of its difficulties, the same baleful route has been followed century after century by panting, famished caravans. Nothing illustrates more forcibly the strength of the distinctively human passions for novelty and gain, or whatever it is that leads to trade and the pursuit of wealth. The continued use

of such a route is probably due to the diverse physical conditions of tropical India, on the one hand, which give rise to vegetable products of tea, spices, and dress-fabrics, and of temperate Turkestan, on the other, with hemp which the Hindu smokes to while away the monotony of life, and with various animal products of fine wool, felt, and skins. These diverse products, acting on man's acquisitive nature, induce him to keep open this worst of all roads. If the Karakorum plateau and its flanking ranges had extended north and south as the Andes do, and had separated countries no more different than Chinese and Russian Turkestan, there would have been much less incentive to the establishment of such a route, the products of the two regions not being sufficiently diverse.

Chinese Turkestan is connected with the outside world, other than China, by two routes, those of Karakorum and Terek Davan. The latter runs westward from Kashgar, at the western extremity of the country, to Osh and Andizhan, the terminus of the Central Asian railroad in Russian Turkestan. Since the completion of the railroad, it has largely supplanted the Karakorum route as an avenue for the importation of the manufactured products of Europe. In every way it is an easier route than the other, for it rises to an elevation of only about 12,000 feet, and the part at a high altitude can be crossed in a day or two. In the past, however, as now, communication with the west by this route, more frequently than by the other, must have been interrupted by wars, during which travelers and merchants were forced to use the harder, but cheaper and more peaceful Karakorum route. Even lately, so remote a geographic

impulse as the disorder created by the struggle of the competing nations of Russia and Japan for the coast of the Pacific has outbalanced the influence of the Central Asian railroad, and has turned considerable traffic to Karakorum. When we were at Ladakh, the price of horses and grain showed symptoms of rising, because it became known that about fifteen hundred Mohammedan pilgrims returning from Mecca to their homes in Chinese Turkestan were coming up through India to Leh. Many would have gone by way of Russia; but the examination of passports and the exactions of petty officials, always much dreaded by the pilgrims, were so much worse during the war, that they dared not go that way. One of the pilgrims who overtook us had been to Mecca twice. On his first journey he had traversed Russia, so he told me. There he had been obliged to pay twenty-two and a half dollars duty on nineteen dollars' worth of cherished dates and other presents for his family from the holy city of Mecca; and had been asked for his passport whenever he left the train. Fearing that matters might be worse in time of war, he had this time traveled through India, and, like many others, was loud in his praise of that country and its freedom from espionage. He could not praise Bombay enough — its wide streets and fine buildings, its freedom from prying police, its railroad station where you knew that you were paying only the right price for your ticket, and above all its economical bazaar, where, under the strict rule of the Sahibs, an official list of the prices of all articles is posted at frequent intervals, and there is little or no bargaining.

The simple pilgrim's tale of his two journeys to Mecca,

related as we sat under a mulberry tree in a narrow valley at the northern base of the Kwen Lun mountains, contained an epitome of the geography of Asia. The component elements of his conception were first himself and his Chanto people, the mild, courteous, not over-valiant, and none too honest product of generations of life in the sheltered, uninspiring environment of irrigated oases among the deserts of Central Asia. Closely connected with his daily life was the government, of whose rapacious officials he mildly complained: the Chinese, whose slow, imperturbable, ever-persistent tenacity and economy are perhaps the result of thousands of years of the dull, hard struggle of a teeming population against overcrowding in a land of splendid possibilities, uninfluenced by great changes either from within or from without. A more important factor in his life was his religion, the fanatical creed which seems to have imbibed its nature from the stern inexorableness of the desert, on the one hand, and the utter relaxation of the oasis, on the other. Drawn by religious zeal, and repelled by Chinese stolidity, our mild Chanto pilgrim started westward on his first pious journey, following the easy route along the line of oases at the northern base of the great central mountain system of Asia to the Caspian Sea, and so across Trans-Caucasia to the Black Sea and Arabia, and finally back again. There was much that he liked, and the railroad was a keen delight; but he could not understand the inquisitive, aggressive new race of fair-haired men from the north, and could not protect himself from the half-Russianized races who fleeced him right and left. When again he was about to go to Mecca, he heard of new factors, a race

of little people called Japanese, whose fathers, so report said, were English, and whose mothers were Chinese, but at any rate a people who had fought and whipped the Russians. It would not be pleasant in Russia, he and his friends thought; it would be better to go by way of India, where it was reported that food was cheap and officials not inquisitive, even if the way was execrable. So it happened that on his return I met this highly traveled, ignorant pilgrim under the mulberry tree, and found that unconsciously he had grasped the essentials of the geography of Asia. From his standpoint in Central Asia, the world was chiefly desert with some oases. Had he not seen countries of that sort from far away in Mongolia to the ends of the earth in Arabia? China, known to him as "Bajin" (Pekin), stood for civilization, something vast, populous, and unknown; the land of his rulers, to be sure, but a place whither he had no thought or desire of going. Russia, by which he meant Siberia, was a broad land, easy to traverse and interesting, but not a place in which to stay, for it was expensive, and its people were prone to investigate the affairs of others. And finally, India, under its Sahib rulers, represented plenty, freedom, and honesty, coupled with impenetrability, for it lay beyond the frigid ranges of the "Abode of Snow," and the breathless desert of "Black Gravel."

CHAPTER IV

THE HEART OF ASIA

FROM the sharp ridge of the Sanju pass, at a height of 16,700 feet, the view to the north gave us our first sight of the great Lop, or Tarim basin, in the very heart of Asia. Near at hand, huge glaciers wound their ribbed way down from the unnumbered nameless peaks, which they themselves, by cutting headward, had carved into sharp triangles resembling the famous pyramid of the Matterhorn in the Alps. Two or three thousand feet below us, at our very feet, as it seemed, the steep amphitheatre of a huge cirque, or corrie, formerly occupied by a glacier, ended in a broad expanse of old moraines. Instead of the boulders and rough hollows which one usually sees in moraines, these presented surprisingly soft outlines, for they had been deeply buried in loess deposited from the atmosphere. The loess was covered with thick grass, full, as we soon saw, of countless alpine flowers, and dotted with sleek flocks of sheep and herds of cattle. Farther away the moraines contracted, and finally came to an end where the stream which drained them plunged into a deep gorge and was lost to view among a maze of rough, naked mountains. The brown and gray flanks of these lower heights sloped steeply, and some of the ridges were sharp; but their nakedness, and the absence of snow and of dominating peaks, made them comparatively uninteresting. Our gaze went out far beyond them to where the last low hills gave place to a strange yellow band. It

seemed at first to be the sandy desert of the heart of Asia; but during the two hours of our stay on the pass, it expanded and rose, and we then knew it for the inevitable dust-haze which shrouds the country more than half the year.

We were looking down into the great enclosed basin which, as the map of Asia shows, occupies the very centre of the continent. It stretches east-northeast for fourteen hundred miles from Kashgar to Su-Chow, and has a maximum breadth from north to south of over four hundred miles. Except to the northeast, toward the Desert of Gobi, where there is a region of low, maturely dissected mountains, the basin is sharply bounded by lofty, newly uplifted plateaus, diversified with mountains which rise to a height of from 15,000 to 25,000 feet. The edges of the plateaus are marked by steep ranges, such as that of Kwen Lun on the south, forming the northern escarpment of Tibet and the Karakorum plateau, those of the heights of the Pamirs on the west, and the southern range of Tian Shan on the north. Within the ring of encircling mountains, the basin floor is composed of a broad desert zone of gravel surrounding a zone of vegetation in which most of the villages and towns are situated, and which in turn surrounds a great central desert tract of sand and salt. The entire basin, which is as large as the portion of the United States east of Lake Michigan and north of Tennessee (three times as large as Great Britain and Ireland), drains to the salt lake of Lop-Nor. At least it would drain thither, if most of the streams did not wither to nothing in vast slopes of gravel and plains of sand. The principal river, the Tarim, or

Yarkand, flows along the western and northern sides of the basin and drains over half its area. Because of the importance of this river, the region is often called the "Tarim basin." As this name applies to only the western portion of the country under discussion, it seems better to designate the basin as a whole by the name of its terminal reservoir, as is done in the case of the Aralo-Caspian basin, the Titicaca basin, the Great Salt Lake basin, and many others. Accordingly, I shall make little or no use of the term "Tarim basin," and shall use "Lop basin" as the name of the central basin of Asia. The Lop basin, thus defined, comprises the most western portion of the Chinese Empire. Together with the Turfan basin north of Lop-Nor, it forms what is known as Chinese Turkestan; and with the smaller regions of Ili and Dzungaria to the north, is comprised in the huge Chinese province of Hsin-Kiang, the "new province."

The most important factor in determining the character of the vegetation, and hence of the animal and human life of a region, is, of course, its climate. The climate of the Lop basin depends upon the threefold fact that the basin lies first in the middle of the temperate zone, second in the centre of the largest of the continents, and third in the midst of a ring of lofty mountains which completely enclose it. The three factors combine to minimize the amount of precipitation, and to induce great extremes of temperature. From September, 1905, to March, 1906, during most of which time I was in the central part of the basin, I saw no precipitation whatever, though in mid-January, near Lop-Nor, I came upon two or three inches of snow which was

reported to have fallen in mid-December. There are said to be usually two or three slight falls of snow each winter. In summer, from June to August, more or less rain falls. At Khotan, in July, 1905, we had some severe showers, but commonly the amount of rain is very slight. It increases rapidly, however, as one approaches the high mountains; and among or close to the main ranges, at an elevation of 10,000 feet or more, there is an abundant fall of rain and snow. The results of the unequal distribution of rainfall are brought forcibly to the traveler's notice as he descends from the plateaus to the basin floor. At an elevation of from 10,000 to 14,000 feet, he is among pasture lands where the grass is thick and even turfy, but lower down, at a height of from 5000 to 10,000 feet, he encounters only sparse vegetation of the xerophilous or drought-loving kind, like the sage-brush found in the deserts of Utah and Arizona. The change from this poor growth to the almost complete absence of vegetable life in the main floor of the basin, at an elevation of from 3000 to 5000 feet, is equally significant, though less marked. Certain parts of the basin floor are well covered with plants, which, however, are supported by rivers, or by underground waters from the mountains, and rarely or never by rain. It is probable that in the centre of the basin the annual precipitation does not amount to more than an inch or two; although on the high mountains a hundred miles away it may amount to twenty-five or thirty inches. This fact must be kept in mind, for upon it depend the marked contrasts in the vegetation of the contiguous concentric zones of the Lop basin; and these, in turn, determine the distribution and many of the habits of man.

The temperature of the Lop basin varies greatly, but the extremes are comparatively easy to endure, and their effect is much less noticeable than that of the variations in precipitation. During the nine months that I was in the basin, from June, 1905, to March, 1906, the observed temperature ranged from minus seventeen degrees Fahrenheit to ninety. The extremes must have been greater, for I kept among the mountains for the most part in the hot months of July and August, and was at the lowest, warmest part of the basin during the winter, which was not regarded as particularly severe. In general, the months of December, January, and February are intensely cold, the temperature remaining below zero much of the time. The people suffer but little, however, since the areas of vegetation furnish abundant firewood in most places, sheep-skins can be procured cheap from the shepherds among the mountains, and warm houses can usually be made of mud. Moreover, the air is dry, and there is comparatively little wind in winter. The chief difficulty caused by the cold, except where the firewood has all been cut off, is the freezing of the shallow streams which furnish the usual water supply. In some cases, as I saw at Oi-Toghrak, east of Keriya, the difficulty is met by digging wells. They are not very satisfactory, however, because of their great depth, sometimes two hundred feet, and because the water is often impure or saline. Still, it is much more convenient to use such wells than to be obliged to melt ice chopped from the frozen canals and brought home in donkey loads, as we saw in some of the smaller villages. Where the main stream is so large that it never freezes entirely, pools, of such depth that they can-

not freeze to the bottom, are located at the street corners, and, according to Bellew, are filled at intervals by turning the stream into them. To the fastidious Occidental, the practice has certain disadvantages: the dust and dirt blown into the water are never cleaned out; and in summer people wash not only their clothes but their bodies in the pools. At one place, Imamla, — and so far as I could learn, it is the only place in the Lop basin where the practice is followed, — the winter water supply comes from a "kariz," one of the tunnels common in West Turkestan. They are dug under a gravel flood-plain, and slope slightly less than the surface, so that they lie deeper and deeper under ground as they are followed up toward the head at the base of the mountains.

At first it seemed to me that the people of the Lop basin — Chantos, as the Chinese call them, and as I shall hereafter — were remarkably indifferent to cold. Time and again I saw men curled up under small sheep-skins sleeping soundly out of doors in zero weather. Experiments showed that I could readily do the same, and could sleep comfortably under a sheep-skin in the open air with a temperature of at least minus six degrees. The absence of wind, especially at night, makes the low temperature easily endurable. The natives like to keep warm, nevertheless. When we were camped where there were no houses, the guides or pony-men frequently waited about my tent at night to forestall one another in pouncing upon my fire as soon as I left it. They usually dug a shallow trench, put the live coals into it, covered them with three or four inches of soil, and slept on top.

The change from winter to spring is said to come suddenly. April is often so warm that flies and gnats, an almost unendurable pest all summer, begin to be very troublesome. The summers are somewhat trying because of the long hot days and glaring sun. The temperature, even in the shade of the cultivated trees in the irrigated regions, sometimes rises to a hundred degrees. I did not find it particularly disagreeable, however, either in August, 1903, near Kashgar, nor in June, July, and August, 1905, near Khotan. It was much like Utah. The heat was tiring, but if one stayed in the shade at noon, and did not exert himself, it was possible to be quite comfortable. Out in the open deserts of sand and gravel, however, the heat and glare were terrible. Even in September the sun raised the temperature of the sand in the Keriya desert to such a degree that one could not walk on it barefooted. In addition to the heat, the summer, like the spring, has an extremely disagreeable feature in the strong winds, generally from a northerly quarter. They rage violently at frequent intervals, darkening the air with dust from the never remote desert, filling one's eyes, nose, and mouth with dust and gritty sand, and making every one irritable.

By the middle of September in 1905, — and such, I believe is usually the case, — the winds had largely ceased, the hot season was past, and the weather was almost ideal. The air was crisp and invigorating; one could work hard in the sun, or sit still in the shade, without discomfort. Day by day the weather grew cooler and more bracing, but there was rarely any sudden change. In October I began to have a fire of dry tree trunks in the evening, but the days were

mild. It was not till the end of November that the inspiring coolness of autumn changed to the dulling cold of winter. On the whole, the climate of the floor of the Lop basin is excellent. The extremes are neither debilitating nor deadening; the dry air and the freedom from sudden changes make it healthful; and during certain seasons it is stimulating. Its chief drawbacks are the monotony, and the dry, parching heat of summer. One always knows what the weather of to-morrow or next week or next month will be; one is rarely invigorated by a clear day after a storm in summer; and one never has the stimulus of sudden changes, such as that which rouses all the energies of the farmer to get in his hay before it rains, or the gardener to pick his fruit and vegetables before a sudden frost.

Turning now from the climate of the Lop basin to its character and appearance as a whole, the latter can, perhaps, best be appreciated by comparing the basin to a sea. Indeed, except for the accident of the absence of water for the last few million years, since the Cretaceous or early Tertiary era, it has all the qualities of a basin such as that which holds the Mediterranean Sea. For age after age, a great block of the earth's crust — the basin floor, corresponding to the floor of the sea — has been slowly settling downward, away from the surrounding plateaus, — corresponding to the continents, — which once were approximately on a level with it; or else, what amounts to the same thing, the plateaus have been lifted up, and the floor has moved but little. At the west end of the basin from Keriya around through Kashgar to Uch Turfan, and perhaps to Bai, or Kucha, the dislocation between the plateau blocks

and the basin floor takes the form of a monocline or bend. Farther to the east, from Keriya to beyond Lop-Nor or farther, and from Korla to Ying-pen, where the uplifted portion of the northern mountains comes to an end, it takes the form of a fault or break. The result is a pronounced topographic difference between the more gently descending western borders of the basin, on the one hand, and the sharply cut eastern border, on the other. To the west, the mountains merge somewhat into the plain, and, however grudgingly, invite man, as it were, to enter and occupy them: to the east, the mountains, though battered and dissected, rise steep and repellent, offering no opportunity for roads or settlement. Here, as on the borders of other sharply depressed seas like the Mediterranean or Caribbean, there are evidences of volcanic activity at times no farther distant than the early part of the glacial epoch, as I saw on the Keriya River near Polu.

In order to understand the distribution of life in the Lop basin, we must remind ourselves of a familiar geological process. Ever since the beginning of the differentiation between the plateaus and the basin, streams from the highlands have brought to the basin floor rock waste of all sizes, and have deposited it to a depth of probably thousands of feet. Among the mountains, the streams descend steeply and rapidly, and are heavily loaded with rock-waste, much of which consists of cobbles and pebbles. On reaching the edge of the basin, their velocity is suddenly checked because of the change in grade; and they are compelled to deposit the coarser materials, and to go on loaded only with sand and clay. Little by little these too are deposited, as the

streams grow more sluggish farther away from the mountains; and at last, the very finest particles are deposited in the terminal salt lake, if the streams are able to persist so far. By the long continuance of these processes, the basin floor has been provided with two chief parts. The first is a somewhat sloping zone of gravel, a characteristic piedmont deposit, forming a peripheral ring from five to forty miles wide at the base of the mountains. The second is a vast inner plain of sand and clay, nine hundred miles long by three hundred miles wide, and so flat that it is everywhere sensibly horizontal. The plain is not featureless, however, for it is clearly divided into three parts, characterized, as the map shows, by vegetation, by sand, and by lacustrine deposits.

Vegetation is confined chiefly to a narrow but continuous zone encircling the desert areas of sand and lake deposits, and lying just within the piedmont zone of gravel, to which it is closely related. Occasional narrow tongues or bands of vegetation accompany the larger rivers far out into and even across the sand, but they are relatively unimportant. The relation of the piedmont gravels to the zone of vegetation must be clearly understood, as it is perhaps the most important fact in determining the habitability of the Lop basin. On entering the zone of gravel, the streams deposit their loads of pebbles, and thereby fill their beds, making it necessary for the water to seek new channels, which naturally branch often and are broad and shallow. Thus a large surface is exposed to evaporation, and the streams lose in volume. A much greater loss takes place, however, because of the vast quantities of water which sink

into the porous, thirsty gravel. Most of the smaller streams thus disappear entirely, and many of the larger ones do likewise except during the flood season. The effect is most marked where the break between the plateaus and the basin floor takes the form of a fault, for there the steepness of the slope of the valleys cut in the escarpment causes the streams to be very swift and to bring down a great amount of coarse detritus. The sudden change of grade at the base of the mountains necessitates the deposition of much material, with the result that huge slopes of piedmont gravel are formed. Between Keriya and Cherchen they sometimes reach a width of forty or fifty miles. Only a large stream can succeed in crossing such an expanse of parched, naked gravel. It is evident that the major part of the rather abundant supply of water from the mountains must disappear in the piedmont gravel zone long before it can reach a point where it might support much vegetation, or be utilized by man. The water is not wholly lost, however, for it cannot sink straight downward. The gravel contains frequent lenses of somewhat clayey, less pervious material, along the slightly sloping surface of which the water is obliged to flow away from the mountains. Moreover, the few wells which have been dug show that the lower layers of the gravel are saturated with water, and hence whatever more seeps down from above must tend to flow along the surface of the previous ground water, the level of which necessarily slopes away from the mountains. The net result is that the vanished streams spread out into an underground sheet, which slowly, but steadily, flows toward the centre of the basin. As it gets away from the rather

steeply sloping piedmont region of coarse gravel, and reaches the flatter region of fine sand and impervious clay, it approaches the surface, or rather the surface approaches it, until finally, near the end of the last fine gravels, the ground becomes permanently damp close to the surface. The phenomenon is the same as the so-called spring-line in northern Italy, where the water from the Alps, after flowing underground through piedmont gravels, forms a line of springs. In the Lop basin, where the surface of the ground becomes damp, an abundant growth of vegetation, chiefly reeds, tamarisks, and poplars, is able to flourish without the help of rain. The zone of vegetation thus formed varies in width from nearly twenty miles between Khotan and Keriya, to a few hundred yards at the eastern end of Lop-Nor, but its character is everywhere much the same. It is unmistakable along the entire south side of the basin for nearly a thousand miles, and is almost equally continuous, I believe, on the north side, though there it is much less noticeable because its location is almost coincident with that of the similar zone of vegetation of the eccentrically placed Tarim River. The only part of the basin where the zone cannot be detected is the northeast corner, which is exceptional in many other ways also. Most of the towns of the Lop basin are located in the zone of vegetation; the chief roads follow it, and from the point of view of geography or the relation of the organic to the inorganic, it is the most important feature of the country.

The areas of sand and lacustrine deposits comprised in the central plain are notable as examples of the kinds of regions not adapted to life of any form. They are more

important as showing that in times past, under different conditions, the same regions were more favorable to life. In the eastern part of the plain, widespread deposits of broken and blistered salt, and beds of variegated clay, proclaim that long ago the lake of Lop-Nor was much larger than now. Farther west, the waste of sand known as the Takla-makan desert illustrates the work of the wind. Acting upon the materials deposited by the streams in broad flood-plains and playas, the wind heaps the coarser grains of sand into an endless succession of waves. It carries off the finer particles as a hateful haze, which is finally deposited on the mountain slopes to the south, covering them with soft beds of loess, excellent for pasture-land wherever there is rain enough. In many places the sands of Takla-makan have buried the ruins of ancient villages, or the remnants of ancient vegetation, which could have existed only when the climate was moister than now.

Few parts of the world are so simple in structure as the Lop basin with its marked concentric zones. In few do contiguous regions differ so greatly and change so abruptly in physical character, and hence in their relation to life. The lofty, well-watered plateau zone stands like a continental ring around a sea forever dry. In their colder, more elevated portions the plateaus are absolutely desert; but in slightly lower regions they are covered with rich grass, and in summer support the numerous flocks of pastoral nomads. Sometimes the nomads pass over the edges of the plateaus, and go part way down the long slope leading to the basin floor. In general, however, and especially where the break between the plateaus and the floor takes the form of a fault,

the mountain slope is too rugged in its upper portions, and too arid lower down, to be occupied by man except in the larger valleys. At the heads of these valleys, hardy nomads graze their flocks amid the magnificent scenery of loess-covered moraines and steep valley walls, while far down-stream, beyond almost impassable gorges, charming villages lie like green ribbons on narrow terraces of loess. At the ends of the valleys, a rude transition brings one into the wearisome desert of the zone of piedmont gravel, like a huge beach of dark, monotonous shingle. Sometimes the gravel bears on its lower edge isolated areas of sand-dunes like lagoons of the great dry sea beyond; but oftener it abruptly gives place to the refreshing verdure of the zone of vegetation, a jungle of tamarisks and poplars, broken by broad expanses of feathery reeds, or by areas of cultivation. The zone of vegetation is not all a zone of life; frequent areas contain little except dead plants, slowly worsted in the hopeless fight against a changing climate. In scores of places in this, the sole zone where life is abundant, great mounds from ten to fifty feet in height, capped with the feathery shoots of dying tamarisk bushes, — easily legible records of desiccation, — stand like huge boulders capped with sea-weed between the green tide-flats, so to speak, of the zone of vegetation and the encroaching waves of the great interior desert of sand. The desert, white, yellow, or gray on the edges, reddish in the centre, is beautiful in spite of our presuppositions. Life, to be sure, is absent, but the graceful curves of dune and ripple and the harmonious blending of tints are a continual delight, provided the mind is free from anxiety.

Even the ruins of ancient civilization are beautiful in the clean, graceful shrouds of their interment in the sand. It is only far to the east, in the monotonous wastes of the salt and clay of old Lop-Nor, that one comes to the real "abomination of desolation."

CHAPTER V

KHIRGHIZ NOMADS AND THE INFLUENCE OF THE HIGH PLATEAUS

THE great physical difference between the plateaus and the floor of the Lop basin has notable consequences in the diverse human habits and character of the two regions. Apparently, the physical differences are the cause of the human differences. In order to take the first step in bringing out this geographic contrast between the human inhabitants of the two diverse regions, I shall postpone the account of our journey from the Sanju pass down to the zone of vegetation, and shall devote this chapter to a description of the Khirghiz, a race of Mohammedan nomads inhabiting the high plateaus. As the Karakorum plateau is for the most part too high and cold to be inhabited, we saw but a few score Khirghiz on the way from India to Turkestan. In the summer of 1903, however, as a member of the Pumpelly Expedition of the Carnegie Institution, I spent three months among the Khirghiz of the plateaus to the west and southwest of the Lop basin, chiefly in the western and central part of the Tian Shan plateau. During a residence in Turkey I had learned a little Turkish; and now I found that I was soon able to pick up enough of the Khirghiz dialect of Turki, a language very closely allied to Turkish, to dispense with an interpreter in all ordinary matters. A little knowledge of their language went far to put me on terms of comparative intimacy with my Khirghiz servants,

and facilitated a very pleasant acquaintance with many of the people whom we met.

Wherever I have found the Khirghiz living unrestrictedly under their normal nomadic conditions among the mountains, whether north, west, or south of the Lop basin, they appear to have essentially the same habits and character. So far as I can learn, the Indo-European nomads to the west of the Lop basin in Wakkan and Sarikol, and the Mongol nomads of Buddhist faith to the east in northern Tibet and eastern Tian Shan, all of whom live under physical conditions similar to those of the Turanian Khirghiz, have very similar habits and character in spite of differences in race and religion. This suggests that environment is in this case more potent than either race or religion in determining habits and even character, provided, of course, that the environment is operative long enough. In the following chapters it will be interesting to inquire how far the specific habits and characteristics mentioned are best explained as the product of physical environment, according to the hypothesis of this book, and how far they are the result of other and less easily defined causes not here considered.

The typical part of the Tian Shan plateau which I visited in 1903 lies between Andizhan on the west, Issik Kul (Warm Lake) on the north, and Kashgar on the south. The main physiographic feature of this western Tian Shan region, as of the Karakorum, is that the so-called mountain system is in reality an area of low relief which has been uplifted to a great height, forming a broad plateau. The uplift was accompanied by warping, which has divided the plateau into a series of basins and rolling ridges or

uplands, none of which are as yet extensively dissected by the rejuvenated rivers, whose grade and consequent power of dissection were greatly increased by the change of level. Thus a large part of the western Tian Shan region consists of smoothly floored basins and gently rolling uplands lying at a height of from 10,000 to 12,000 feet above the sea, and therefore subjected to relatively heavy precipitation in summer. The conditions of climate among these "pamirs," as they are generically called according to Younghusband, allow an abundant growth of thick, turfy grass full of flowers. Trees, however, are wholly absent on the main plateau, and are rare even on the lower slopes. Schimper explains this as due to the fact that the wet season in midsummer is not long enough to favor the growth of trees, which require a growing season much longer than that of grass. Nevertheless, in the valleys, at an elevation of from six to nine thousand feet, there are some trees and a profusion of delicate flowers, rich grass, and shrubs.

It is not my purpose to discuss the vegetation. It may be worth while, however, to print here a list of the plants, so far as I happened to record them, which grow wild among the lower slopes of the mountains northeast of the Lop basin, but are cultivated in Europe and America. They comprise the apple, apricot, plum, and olive (not the commercial species); the asparagus, onion, and rhubarb; the candytuft, chrysanthemum, crocus, heliotrope, peony, phlox, and tulip; the large blue and purple varieties of columbine; the pansy and lady's delight, both purple and yellow; and the red, yellow, and white varieties of the poppy and rose. That there are many more than these nineteen

species I am well aware, but those mentioned are enough to show the general character. The names of the plants were originally recorded with no thought of their possible significance. The list is of interest in view of the much controverted theory that Central Asia was the original home of the chief races of Europe. So far as it goes, it supports the theory; for it suggests that the original migrants from Central Asia carried with them plants which there grow wild, and which have since been cultivated in the new lands where the wanderers finally settled.

Returning to our main subject, the first and most important geographic feature of the Tian Shan plateau is, as we have seen, the pamirs, or plains of rich grass. They determine the character of animal life, including man. The climate is so cold, and snow lasts so long, that animals cannot permanently inhabit the plateau in great numbers, unless they hibernate like the innumerable marmots, or migrate like birds; and even the latter cannot find food easily because of the scarcity of insects and of weeds with large seeds. Yet during the summer months the conditions are almost ideal for herbivorous species of animals. Man can easily turn this fact to his advantage, provided he adopts the habit of permanent nomadism. The rich, grassy uplands are capable of fattening millions of sheep and cattle during the summer; but before the winter snow sets in, the flocks must be driven many days' journey down to the dry open plains, or to protected valleys, in either of which places the animals find poor picking compared to their rich summer pasture. The Khirghiz shepherd must change his residence at least twice a year. His family must go with him. All the

men are needed to care for the flocks, and it would not be safe to leave the women and children far away in the valleys. Moreover, if they were left, they would have nothing to do, for there is practically no opportunity for agriculture, and the only work to be done in summer at the winter quarters is to cut a little grass for winter use. Some of the poorer families are sent down for a few weeks in July or August to do this. As a matter of fact, the shepherds move their dwellings much oftener than twice a year, for the best pasture is found close below the ever-shifting snow-line. It takes but a few weeks to eat up the finest grass near to the tents, and then, either the camp must be moved, or the flocks driven farther. Again, as the animals are brought close to the encampment at night, the ground soon becomes foul, especially during the rainy weather of summer, when there is no chance for it to dry. Thus, by force of physical environment, nomadism is the only condition under which human occupation of most of the Tian Shan plateau is possible.

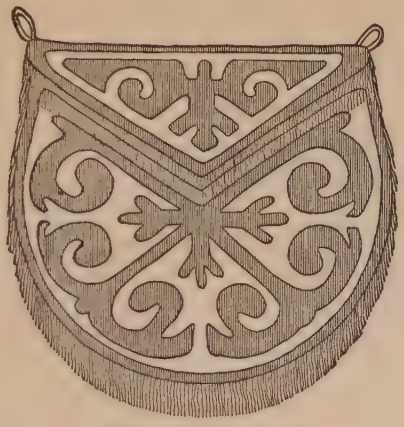
This being so, it is easy to see that the necessity for frequent migrations becomes the main fact in the lives of the Khirghiz, and determines all manner of habits and customs. For instance, dwellings must be such that they can be easily carried from place to place. All men, whether rich or poor, must move equally often, and even the richest cannot have a very large or ostentatious habitation. The materials for houses are willow sticks and woolen cloth, because these are the most easily available. The round tent is thick and tight, in order to withstand heavy rain and snow. It has in the roof a large round hole, capable of being covered with

a felt, but oftener left open to allow the escape of the pungent smoke of dried dung which forms the only available fuel. The most salient feature of the dwelling, however, is the ease with which it can be taken to pieces and moved from place to place. Hence its peculiar appearance and mode of construction, which are more evident from the accompanying photographs than from any description. No iron is used; the lattice-work, made of pieces of willow an inch in diameter, is bound together by strips of raw-hide drawn through holes, while the poles which support the roof are tied in place with home-made ropes of wool. Large felts cover the outside, the lower part of which is sometimes adorned and protected by matting made of reeds a quarter of an inch thick and four feet long, tied so as to stand vertically. The whole dwelling can be folded compactly into pieces of convenient size for carriage by camels or oxen whenever a migration is to take place.

In similar fashion the furniture of a "kibitka," as the tents are called, is of peculiar sorts, corresponding to the materials at the disposal of the Khirghiz, and to the necessity of easy transportation. Utensils are made chiefly of leather and wood, the most available materials which will not break. Again, the dress of the Khirghiz is adapted to the coolness and dampness of the climatic conditions under which the people live. Having described these things, we at once perceive that they in turn limit the æsthetic sense of the Khirghiz. These people cannot know much about architecture or the ceramic art; but they can and do enjoy bright-colored rugs and felts, gaudy leather boxes, gay screens or hanging doorways, and gorgeous robes or delicately embroidered head-

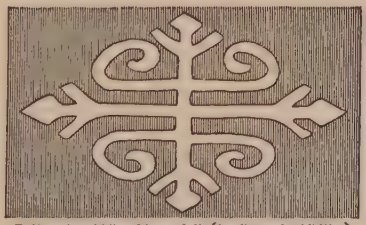
dresses for the women. The designs which the people employ are for the most part simple and highly characteristic, as appears in the drawings on page 113, which were made by Professor Davis in some of the kibitkas where we were entertained. The environment of the Khirghiz limits and controls, but by no means stifles, the æsthetic sense.

A description of some of the events of two days in early July, 1903, when Professor Davis and I traveled from the Narin River up to Son Kul (Left-hand Lake) will illustrate some of the points already mentioned, and will give an idea of the daily life of the people. From the ford of the Narin River, an easy ride up a pretty mountain valley brought us to a group of kibitkas, set in a green amphitheatre surrounded by steep walls of gray limestone. An unusually neat kibitka, so new as to be still white, was evidently being prepared for us at the suggestion of the Khirghiz guide, who, of his own accord, had ridden ahead to see that all was ready for our reception. The kibitka had been picked up bodily, and, as we approached, was being carried to a cleaner spot away from the unpleasant neighborhood of the other kibitkas and of the flocks and herds. A dozen men and women had gone inside, and picked up the kibitka by the lattice-work fence. Under the direction of a man on the outside, who acted as eyes for the rest, they were carrying it blindly to the designated spot. It looked like an enormous beetle, walking across the turf with a dozen pairs of human legs. The household goods which the kibitka had sheltered — the piles of rugs, felts, quilts, skins, boxes, bags, wooden bowls, and leather buckets — were left exposed in a sorry heap, which the women good-naturedly removed to another tent.



Fringed Bag (for wall of kibitka)

Bands of woolen cloth (used for tying the walls of a kibitka)



Pattern in middle of large felt (for floor of a kibitka)

KHIRGHIZ DESIGNS

COPIED BY

W. M. DAVIS

Blue
Red
Brown
Light Brown

In the evening, our Khirghiz village was in perfect order. Ten or fifteen kibitkas were scattered on a fair green slope between the steep gray cliffs. On one side, hundreds of stupid sheep were trying to push their way into the centre of the flock; on the other, herds of neighing, kicking horses, fat mares, and frisky colts were interspersed with stolid cattle and with camels — awkward two-humped beasts, strangely out of place among the lofty mountains, and ridiculous in felt coats put on to keep them warm and, especially, dry. In the morning, the village was in dire confusion. Kibitkas were lying in pieces on the ground with household goods strewn around them. A migration was to take place, and men, women, and children were busily making preparations. The slow-moving, pattering flocks of sheep had already been sent away at dawn, but the rest of the animals disported themselves among the ruins of the tents, waiting to be packed or ridden.

The men of the community were clad in big top-boots, black conical hats of heavy felt with brims of Astrakhan, and long quilted cotton gowns, which had been wet so often as to appear dark and oily. Their chief business seemed to be to load the animals, or to catch those which were still loose. When a horse was to be caught, a man seized a pole like a fishing-rod with a loop of rope at the end, and jumped bare-back on another horse which was already bridled. Violent kicking and lusty shouting started both horses into a fine gallop, and it was sometimes half an hour before the loop was thrown over the animal's head.

The women wore heavy boots and quilted gowns much like those of the men. Many, however, had taken off the

outer garment, and were dressed in loose gowns of white cotton, or, in the case of the rich, of gorgeous silk, red, purple, and yellow. The sleeves of the garments of both sexes extended five or six inches below the hands, and took the place of gloves as a protection against cold, especially in riding horseback. The headdresses of the women, often a foot high, were wonderfully constructed of fold after fold of white cloth wound into a cylinder. One fold hung over the ears and under the chin in such a way that it could be drawn up over the lower part of the face, although this was rarely done. From below the huge headdress the black hair hung in silver-studded braids, pieced out with cords or strings of leather. At the ends of the braids, one or two silver roubles and the keys of all the family chests dangled close to the women's heels.

When one of the kibitkas had been tied up ready for packing, a tiny girl of six led up a camel ten feet high, and in spite of the creature's horrible grunts and roars, made it kneel meekly by twitching the rope fastened to a stick in its nose. The largest, finest camel was adorned with a long red fringe, which hung over the saddle and over the animal's long, curved neck to its head. When two men had tied a load of pots, pans, boxes, felts, and parts of a kibitka securely to the camel, I saw a silk-gowned mother lay her baby in a wooden cradle without rockers. After covering it well, she tied one rope over its legs and around the cradle, and a second over its chest. Then, in spite of its lusty crying, she lifted the cradle unconcernedly to the top of the load of the kneeling camel, lashed it on, and covered both baby and load with a large rug. She did not mean to neglect her

baby, but though she was one of the richest women of the community, she, like every one else, had to work that day. Cradles of the sort in which this mother laid her child figured sadly in a scene which I saw later. Out on a lonely hill-top among the great mountains we came upon a group of graves. Beside each of the six smallest heaps of earth there stood an empty, weather-beaten cradle.

Camels were not the only baggage animals that morning. Horses are esteemed too highly to be often burdened with loads, but frequently we saw a man on one side of a stout ox and a woman on the other, each with the right foot braced against the animal's side while they drew taut the ropes which bound the load of kibitka poles. A monkey-faced dog slunk behind one such pair, while close by, a girl of ten in figured red and purple silk waited to be helped on to her horse. Beside her a tiny imp of three stood motionless; his round, astonished face, long gray dress, and boots so high that he could not bend his knees, all sunk into insignificance under the immense dome of his black sheep-skin hat. Even he could ride a horse, as we soon saw.

At last, when all was ready, we started on a delightful ride up a steep gorge. The road zigzagged among fine spruces, almost the only ones that we saw in Central Asia. We passed first a man on a cow, then a heavily loaded camel with two small boys perched high on top of the load, and two ridiculous baby camels, too small to carry even a roll of felts, running awkwardly in the rear. Next two fat cows with wooden rings in their noses walked placidly along with loads of straw-matting and poles. In front of them an old gray-beard with a black hat and a wadded gown

rode proudly on a spirited horse. His gloved right hand rested in a wooden crotch at the upper end of a short stick which stood in a little stirrup, and on his wrist perched a hunting-eagle with a leather hood over its eyes. Behind the man a four-year-old urchin, a miniature of his grandfather, planted his feet sturdily on the horse, while his hands firmly grasped the old man's shoulders. Ahead of this pair a ragged lad, mounted bare-back on a yearling steer, jogged along contentedly behind a herd of horses and colts. In spite of his rags, he looked happy, well-fed, and warm. So, too, did all the people on that day's march; and, indeed, all the pastoral nomads whom I have ever met seemed to be comfortable. When their flocks diminish and they grow poor, they are obliged to seek new homes, and to betake themselves to agriculture, leaving only the rich to continue the nomadic life.

As might be expected from their surroundings, the food of the Khirghiz is very limited in variety, and is eaten in the simplest way. A typical meal, such as one in which I shared and many at which I was a spectator, is likely to prove unpleasant to civilized nerves. One day, as I sat cross-legged with a circle of Khirghiz on the gay felts which carpeted most of the floor of a rich kibitka, our host came in, holding up the skirt of his gown full of dried dung. With this he kindled a pungently smoky fire on the stones in the middle of the kibitka floor, and on the flameless conflagration put some tea to boil. When this began to simmer, he took from the lattice-work of the kibitka a cloth heavy with grease and dirt, and spread it before me, questioning the entire circle meanwhile as to the advisability of serving cream with the tea.

After much discussion, a boy was sent to fetch both milk and cream, while the host placed on the dirty cloth a metal tray containing small pieces of bread and sugar. The bread was in the form of cubes half an inch in diameter, such as I had seen the plump, red-cheeked women cooking like doughnuts in hot fat at the bottom of enormous iron bowls, the sole cooking utensils. Among the strictest nomads bread is a great rarity, and I have had the pleasure of giving a piece to children who had never tasted it before. After the tray was in place, our host took some china bowls from their nest in a round wooden box, and having wiped them with another greasy cloth, filled them with tea. By the time this had cooled, the boy returned with news that his quest had been successful. At his heels followed a fat Khirghiz housewife, who dived into the small woman's sanctum behind the ornamented screen of reeds which invariably stands on the right as one enters the door, and with a wooden ladle scooped almost solid cream from a large wooden bowl into a small china one, and then poured milk from a leather flask into another smaller wooden bowl. As she handed the milk and cream to one of the men, she saw that bread was needed on the tray. Kneeling before a red and green leather-covered box, she reached behind her heels for the silver-loaded bunch of keys suspended from her long braid of straight black hair, and, finding the proper key, took from its safe repository a handful of carefully treasured bread. Now the tea-drinking began, and it continued till the supply was exhausted. Each guest had three or four bowls, but even that was not enough, so each one finished with a wooden bowl of "kumiss," the fermented milk that still remains one of the

most important articles of Khirghiz diet. Then when the servants had smacked their lips over the remains of the meal, each man, with a look to see that his neighbors were ready, raised his hands to his face, and all in unison stroked their beards, with a muttered prayer to Allah.

During the next hour or two, big stories of brave deeds and travel were told, or less praiseworthy talk of quarrels and women kept the party animated at first, but soon the kumiss took effect, and drowsiness began to prevail. At length, to the relief of all, the host appeared, and we knew that the real meal was at hand, for the tea-drinking is, after all, but a new-fangled Russian notion. In his hand, at the end of a spit, he bore a small piece of roasted fat from the immense kidney-shaped tail of the sheep that we were to eat. Pulling his big knife from his girdle, he cut off morsels and placed one in the mouth of each guest as an appetizer. Behind the host came his boy, bearing a basin and a copper urn of water, from which in the oriental way he poured water over the hands of one after another of the squatting circle, beginning, of course, with the foreigner as the most honorable. As the Khirghiz put out their hands to wash, they made a peculiar gesture in throwing back their long sleeves.

The washing over, dinner followed promptly — an enormous quantity of boiled mutton in a huge wooden bowl, flanked by two smaller bowls full of the broth in which the meat had been cooked. The host waved his hand over the bowl and cried, "Eat;" some one else cried, "Eat;" and then each cross-legged Khirghiz cried, "Eat," and, whipping his knife from his girdle, plunged his hand into the dish. The

scene that followed was like the feeding of wild animals in a menagerie. Each man grasped a bone, and with his knife and teeth ripped off huge chunks of meat or fat, and with a mighty sucking and smacking drew them into his mouth. The daintiest portions, the head and liver, were offered to the elders of the feast, who skillfully gouged out an eye and yanked out the tongue. When the edge of appetite had been appeased with two or three pounds of meat and a pound or two of fat, most of the guests took a drink of soup, and then, with idly hanging greasy hands and greedy eyes, watched while the epicure cracked and sucked a bone, and one or two of the more skillful carvers prepared a delicate hash. The fat tail, which is really delicious, a selected portion of the liver, and a good supply of other fat and meat were most cleverly sliced into fine fragments and mixed with soup in the bottom of one of the bowls. When the mixture was ready, each man rolled up a handful and sucked it noisily into his widely distended mouth, or, as a mark of respect and affection, put it into the mouth of his neighbor. The meal was over in an incredibly short time — the last bones were cracked and thrown to the edge of the kibitka; bowls of soup, followed by kumiss, were again passed around; the big top-boots were oiled by cleaning the greasy hands upon them; the beards were stroked; and the main business of life was over. Day after day the diet is the same as at this feast, except that the amount of meat is less and of kumiss more. The mutton is occasionally fried or boiled in its own fat, or roasted on a spit. Sometimes a young colt is killed, and is eaten as the greatest of delicacies. The meat, the one time that I ate it, tasted like a cross between the best grades

of veal and lamb, and was fit for the table of the most exacting epicure.

Just as the Khirghiz habits of eating are the result of an environment which compels the people to live on animal food, so their hospitality is the result of that same environment, which isolates them, and at the same time compels them to travel. Habitations are so often moved that special accommodations for wayfarers do not exist. Yet the nomad, in his search for stray cattle, in his business of exchanging animals, or in his rides between the shifting summer camp and the lower valley where he cuts the winter supply of grass, must often spend the night far from home. Everywhere the people are in the habit of receiving guests, and the custom is to pay nothing for entertainment. In spite of his lonely life, the Khirghiz meets the traveler with less suspicion than does the less cosmopolitan villager who lives near a large city. Usually, when I arrived at an encampment, the chief man, who had ridden out a mile or two to meet me, jumped off his horse and gave it to an attendant. Then he led my horse as close as possible to the kibitka which I was to occupy. As I dismounted, he put his hand under my shoulder to assist me. When I touched the ground he raised his cap, a habit learned, probably, from the Russians. Then he took my right hand softly between both of his, and finally stroked his beard, suggesting a prayer to Allah. Often when we met strangers on the road, they turned and rode with us, to do us honor, and to get the news. The isolation of the Khirghiz accounts for their eagerness in this latter respect, and the abundant leisure of the nomadic life accounts for the unconcern with which a man puts off

his work for half a day. These chance encounters on the road were often most interesting. One day, as I was crossing the Jukuchak glacier south of Issik Kul, five men appeared on the ice above me, one mounted on an ox, one on a cow, and three on horses, with a loaded camel bringing up the rear. All these five strangers dismounted from their slipping animals and, walking across the treacherous ice, gravely shook hands with me.

Another hospitable Khirghiz habit appears to be a direct result of the nomadic life and the abundance of animals. On entering the main Tian Shan plateau, I found that each day fresh horses were brought for me and my men, and even for our baggage. At first I understood the servants to say that our horses were tired and needed rest, which was true, but when I offered to pay the hire of the supplementary horses, I discovered my mistake. In these regions, it appears, the traveler is theoretically supposed to start from home, and to return thither by the way that he went. The first day he rides his own horse, and at night turns it out to feed with those of his host. In the morning he does not take his own animal, but a fresh one from among those of his host. This he again leaves at night, and so on day after day. On the return journey, he picks up at each place the horse that he left there and returns it to its owner. In practice, the scheme is not so simple. In our case, we were furnished daily with from six to ten horses belonging to various people at the camp where we had spent the night. At the end of the day's march, or occasionally in the middle of the day, we gave up the animals to one or two men who had come with us for the purpose of driving them back. For all this the people

would take no pay whatever, though it was often offered. So freely does one man make use of another's horses that not infrequently, when we passed a new herd, some one would say, "My horse is bad," and would dash off to catch another with a fish-pole. I do not know how universal the custom is, but during our journey the changing of horses played so important a part that the stock remark was not about the weather, but "How is your 'animal' to-day? Has he a good gait?"

The sports as well as the labors of the Khirghiz result from the physiographic conditions which induce nomadism. Horses and horseback riding are the one idea of these people, and their greatest sport is the "bagai." I saw this interesting game in the Alai valley, close to the border of Bokhara. As we came down the hillside to the smooth plain, a crowd of distant horsemen seemed to be standing motionless, until one darted out, and the whole fifty or sixty dashed after him. Evidently they were chasing a leader in some game, and the leader kept changing. Drawing nearer, we saw that two galloping horsemen had detached themselves from the crowd and, as they rode toward us, were struggling for a large black object bigger than a sheep. Suddenly one of them threw his leg over this, gave it a jerk which nearly dismounted his rival, wheeled his horse to the left, and, dashing up to me, threw the thing at my horse's feet. It was a black calf, headless and footless, and partly skinned. At once three or four men who galloped up behind the leader leaned from their moving horses and attempted to pick it up. Two grasped it, twenty or thirty others surrounded them, and all struggled to seize the calf and carry it off. In

the *mêlée*, the horses jumped and turned this way and that, while all the riders tried to force a way to the middle of the fight, whipping their own and other people's horses, taking horses by the head and turning them suddenly round, and themselves leaning far out of their saddles as they grabbed madly at the black calf. At last one man captured it, threw it over the front of his saddle, put both legs over it, and was off at a dead run with fifty others after him. They could not catch him, and, making a great sweep as large as the terrace allowed, he returned in triumph to throw the beast before me and get the customary reward.

Then began another scrimmage, in which one over-zealous rider was knocked from his horse and apparently trampled on, but when the kicking, surging crowd of horses had passed, his horse was still with him, and he mounted and galloped off with a grin. After half-a-dozen scrimmages, one daring rider seized the prize and went over the terrace, down a hundred-foot slope so steep that a footman could scarcely climb it without zigzagging. At the foot, the bold rider, hard pressed by his pursuers, cantered across a broad arm of the river, and away across the plain beyond, trying as he went to skin the calf, for he who carries off the skin wins the "bagai."

We rode away with the "Deyem Bai," the giver of the entertainment, who was homeward bound to inspect the cooking of the sheep for the feast that was to follow. It is the custom, I was told, for men of wealth to furnish a goat or calf for the "bagai," and to invite all the men of one or two villages to join in the sport, and at the end to indulge in a feast, or better, a carnivorous orgie. Among the occa-

sions for a "bagai" are a marriage, the birth of a son, the erection of a new kibitka, and a death. Possibly this struggle for a dead animal is a relic of the time when the ancestors of the Khirghiz really fought to get the prey from one another. Whatever its origin, it is a wonderful training in horsemanship. For some reason, no woman is allowed to see the "bagai," or, naturally, to join in the subsequent feast.

The completeness with which Khirghiz life and character are determined by natural surroundings makes the relation between physiography and life far more evident than in the case of more highly civilized people. If the nomad is to be successful, the keenest of eyesight is necessary to detect cattle or encampments at a distance. I was amazed one day to hear my guide say, "Do you see those cattle off there at the foot of the mountain? They are Chinese animals — yaks." After a long search I found them, mere tiny specks of black, so far away that even with a strong field-glass I could barely distinguish them from ordinary cattle. That my guide should recognize them as yaks shows a keenness of sight equal to that of the most skillful hunting tribes of savages. Other Khirghiz showed equal quickness in detecting smoke, kibitkas, men, and animals at a distance, so that the trait seems general.

His mode of life makes the Khirghiz able to endure hunger, thirst, and fatigue, for these are the necessary accompaniments of long rides in search of strayed cattle. He has no fear of raging fords or slippery passes, and despises the Chanto or Sart of the city, who shrinks from crossing a ford where his horse may lose his footing and be washed down-

stream. In such rough experiences the Khirghiz learns to be self-reliant, and his frequent meeting of strangers under all sorts of circumstances gives him an air of readiness and self-possession. The talk of the Khirghiz is full of roads and travels. If you ask a man how far it is to a certain place, he at once begins to tell you all the intermediate stages and their difficulties. These people have the knowledge of their plateau that comes from experience, but book knowledge is very rare. As my escort, a proud, influential Khirghiz, said one day, "Why should the Khirghiz learn to read? It is enough for us to know about sheep and horses and cattle. What more do we want?"

If there were no outside world with which to come in contact, such a view of life might perhaps be wise. As it is, the Khirghiz cannot stand against the hard realities of civilization. The coming of the Russians, who now rule most of the native tribes, has done them an immense amount of good in making the country peaceful and safe, and in providing good markets for the products of the flocks. It has also added to their happiness by making such luxuries as tea, sugar, bread, and cheap cotton cloth accessible to all, but it will harm them if it leads them to abandon the pastoral life for that of the day laborer. The delightfully gentle and gracious courtesy of the Khirghiz cannot offset their laziness, if that term can be properly applied to a quality which is a necessary outcome of the nomadic life. A nomad is justified in being often idle, for his great exertions at certain times compel him to rest at others, but the qualities so engendered are of no use when steady work is required day after day. Thus it comes to pass that those Khirghiz who

have come into close contact with the Russians seem to be deteriorating. Laziness leads to dishonesty, and both tend to insolence and vulgarity. A change of habits, too, causes greater uncleanliness, for customs that may be harmless where a camp is shifted every month or oftener, lead to filthiness where a kibitka stays for six months or a year in one place. Change of any kind is always difficult, especially for people like the Khirghiz, who have adapted themselves completely to a type of physiographic conditions so unusual as those of the Tian Shan plateau.

Not only the outward habits of life, but also certain mental and moral qualities of the Khirghiz are due largely, if not entirely, to physical environment. We will now take up one or two among the many subjects where such a relation does not at first sight appear, although I believe that it exists. In determining the mental and moral character of a people, no factor is more important than the position of women, and the resulting character of the homes in which the children grow up. If the position, and hence the character, of women is materially affected by physiographic environment, it follows that a host of other characteristics must be indirectly affected through the tremendous agency of the home and of early training. I freely admit that religion, heredity, tradition, and perhaps other unknown factors play an immense part in determining the character of a race, but these, too, in their origin and growth have probably been greatly influenced by physical environment. With that, however, we are not now concerned. It will be enough to point out certain ways in which the physiography of the Tian Shan plateau, working through the institutions

of nomadic pastoralism, affects the position of women. If our conclusions are correct, all character is influenced, more or less, by physical environment, and hence is one of the subjects with which geography is concerned.

Mohammedanism, as every one knows, inculcates the seclusion of woman, and makes of her nothing but a stupid drudge to do man's work, or a light plaything for his pleasure. Wherever people of Muslim faith gather in towns and cities, as I have seen them in Turkey, Persia, India, Asiatic Russia, and Chinese Turkestan, this ideal prevails. In the crowded villages and cities women can do their work behind high mud walls, and can be confined to certain unseen rooms when male guests visit the house. The support of the family does not depend upon them, and their activities are almost wholly dependent on the will of their husbands. It is but rarely necessary that they should leave the house, and when they do, there is usually no work to be done and it is easy to keep their faces covered. Even the peasant women, who must work in the fields, keep aloof, and come in contact with men but little. Only the very poor, or those who are confessedly immoral, go about in public with unveiled faces. The evil effect of all this has been often described, and needs no comment.

Among nomads the case is different. The women of all races, so far as I know, both Mohammedan and non-Mohammedan, go about unveiled, and have a strong influence in the affairs of the community. Their relative strength of character is evident from the notable fact that when a Turkoman woman is married to a Persian, or a Kurdish woman to a Turk, the wife from the nomad stock, so it is

said, usually rules the harem, and often rules the whole house. The universality of the contrast between the position of woman in nomadic and non-nomadic Mohammedan populations goes to show that the contrast is not the product of racial differences, but of nomadism.

The house of a nomad must of necessity be small, and cannot contain two rooms, save under the most exceptional circumstances. A visitor must enter the room where the women are at work, or else the women must work outside; and there, of course, they cannot be prevented from being seen by men other than those of their families. Then, again, at the time of migrations there are no shelters left standing, and the women cannot possibly be kept concealed. Moreover, they cannot be made to veil their faces. No one can work with a cloth hanging down over her face. The village woman bakes and brews and washes, and milks her few sheep and goats, in the seclusion of her own courtyard, where she can throw off her veil in the assurance that no strange man will see her. The nomad woman must work in semi-publicity, and cannot be bothered with a troublesome veil, especially when both hands are more than occupied in milking some of her many sheep. Accordingly, while the Khirghiz woman is very particular about her headdress, she makes no attempt to conceal her face. She is in the habit of meeting strangers, whether men or women, and she does it modestly, though without timidity. Indeed, she makes a most admirable hostess. Her freedom from seclusion does much, both morally and mentally, to elevate her above her less fortunate sisters of the villages.

Another side of nomadic life tends to strengthen the char-

acter of the women. They are obliged to rely more or less upon themselves, and to take the initiative at times. In their care of the flocks and herds, it often happens that the men are all far away throughout the whole day, and at certain seasons, when the grass must be cut in the valleys, many of them are away for several days. At such times, the women are responsible for everything. I have come to an encampment of seven or eight tents where no one was left except a few girls and one or two old women. The smaller girls, not unnaturally, were afraid of us; but the newly wedded wife of the chief man, a pretty girl of sixteen, entertained us most graciously, and by the time that her husband and the other men arrived, had supper ready for them and us. A veiled village woman would have screamed and run away at our approach. Besides all this, the occupation of the men with the horses and larger animals leaves to the women the care of the sheep when the flocks are driven home at evening. And, finally, it is always the wife who has the responsibility of taking down and packing the kibitka, and setting it up in a new place, while the husband takes care of the herds. All these differences between the women of Tian Shan and those of the villages are the direct results of nomadism, and all of them tend to make the Khirghiz wife stronger, more capable, and more self-reliant, and hence a better mother.

In view of all this, is it going too far to say that the relatively free, warm-hearted, and affectionate spirit shown by the Khirghiz in their relation to one another is, in part at least, a geographic fact, the result of physical surroundings? In Karategin, at the eastern corner of Bokhara, I

had a most pleasant glimpse of the inner life of a Khirghiz family. As we entered the village of Kichik Karamuk, I spied a villager making a rude sledge of the sort which the semi-agricultural Khirghiz use for hauling grain and hay, and style "arbas," or carts. Of course I wanted to photograph it, and told my servant Sherif to ask the carpenter to sit out farther into the light. Sherif, for some reason that I did not catch, said that it was impossible, but as another servant put the man in the right place, I took the picture before asking any questions. The sledge-maker proved to be Sherif's brother, whom he had not seen for seven years. Out of sheer politeness, the brothers remained silent till the picture was finished, then they embraced each other gently, as wrestlers might clinch before a struggle, first on this side and then on that, repeating very often and very fast the greeting, "Salaamet, salaamet, salaamet" ("Peace to you, peace to you, peace to you"). Later, I saw Sherif meet another brother, the oldest of nine, and an older sister, who had been like a mother to him. The gray-bearded man, who was some twenty years older than Sherif, literally fell on his brother's neck and wept. The story of the Prodigal Son seemed very real just then. Meanwhile the wet-eyed sister stood silent till her turn came. As she fell on her brother's neck, she wept aloud for a moment, and then, still clinging to him, began to chant a song of thanksgiving; and so she continued for some minutes, first weeping and then singing. Feeling out of place, I went into the kibitka and sat down on the floor. After me came a chubby little urchin of three, with a rosy, dirty face and a single scanty garment. A vague idea possessed him that some one had come whom

he must welcome, so with a charmingly friendly smile he came and put his fat arms around me.

In this sketch of the Khirghiz I have tried to take some of the chief facts in their life and character, and to show how they are related to the physiographic facts of the Tian Shan plateau. Beginning with the grosser, more material aspects of life, it appears that the nomadic pastoralism of the Khirghiz is due to the climate and vegetation of the region that they inhabit. On this is dependent the form of their houses, furniture, utensils, and dress, which in turn leads up to and determines the nature of their art. Again, the food of the Khirghiz is narrowly limited by the nature of their occupations, and this in its turn controls the large number of habits which centre about the necessity of taking nourishment. Another line of thought leads from the frequent movements of the Khirghiz to the character of their hospitality and to their politeness. Once more, the hardships of the nomadic life result in certain mental and moral traits, such as bravery, hardihood, and, unfortunately, laziness. Finally, the conditions of nomadic life determine the position and character of the Khirghiz women, and lead to certain of the higher moral traits, such as morality in the stricter sense, self-reliance, and even family affection.

CHAPTER VI

THE SLOPE FROM THE PLATEAU TO THE BASIN FLOOR

ON June 18th, our caravan descended from the crest of the Kwen Lun mountains to the soft grassy moraines at the head of the Sanju valley. The few Khirghiz of this delightful region received us hospitably, according to their wont, but we saw little of them. Living as they do on a frequented caravan route, they have ceased to take special interest in travelers, except as a means of profit. It is a strange anomaly that people who live on much frequented roads, in Central Asia at least, tend to become mean and selfish, with no purpose in life except to exact the last penny from the traveler; while those who travel on the same roads, like the many pilgrims whom we met, become relatively open-minded and generous. The Khirghiz of the Sanju valley were not so bad as the Chinese innkeepers at the lonely desert stations farther north, who not only charged ordinary travelers five-fold for grain, hay, and fuel, but locked up the beggars and poor people who had bought nothing, and kept them till they had paid a few "cash" for the water which they had drunk. It is fitting that men who exact so much remain so poor as the innkeepers seemed to be. Even the good-natured, hospitable Khirghiz have been so injured by proximity to a trade route that though, out of respect to the orders for our reception sent by the Chinese government, they charged us only a fair price for grain, they coolly

charged the next caravan four times as much, though it consisted of the holy pilgrims from Mecca whose acquaintance we found so pleasant.

While stopping with the Khirghiz, we examined several old moraines. It is not necessary to discuss them, for their significance as indicators of pronounced, world-wide changes of climate in the most recent geological times is well known. The most peculiar quality of the Kwen Lun moraines is that they are shrouded in typical loess, a close-grained, yellowish deposit of the finest dust, unconsolidated, and yet so tenacious that for years a perpendicular face will hold the marks of the spade with which it was cut. Wherever the slopes outside the moraines were not too steep, they were likewise shrouded with loess, and wherever there was loess, there was also vegetation. Our first day in the Lop basin happened to be unusually clear, but, as we saw from the Sanju pass, a yellow haze lay low over the desert fifty miles to the north. As the air grew hot, the haze gradually rose and expanded. That night a strong north wind came up. In the morning, as we looked out from our camp among the moraines, the whole country was enveloped in a haze of dust which we at first took for thick, dirty fog or cloud. When the wind died down for a time, the haze began to settle, the mountain tops appeared, and the sky overhead showed a faint bluish tint, though the lower hills, scarcely a mile away, were invisible. When the wind blew again, the dust was whirled upward, concealing the mountains and the sky. We could not see or feel the dust except as a haze, and were only positive as to its nature when the air, forced upward over the mountains by the north wind, became so cool that

rain and hail began to fall. When the hailstones melted on a piece of dark cloth, each one left a spot of dust which it had gathered in the air, typical yellowish loess, of precisely the same nature as that which covered the moraines and mountain slopes. The dust could not have been of local origin, for the region nearby was well covered with grass, and was receiving accessions of loess rather than giving them up. Apparently, the dust came from the desert far to the north.

During the next few days, we descended twenty or thirty miles into the narrow Sanju valley. Even at so short a distance from the main mountain range there was a distinct decrease in the amount of rain, as we could see from the vegetation, and also from the clouds which gathered thickly over the main range, but only thinly over us. The loess, too, began to grow thinner, and in many places was being dissected by wind and rain. It soon became evident that though dust from the desert was deposited everywhere, it accumulated into thick deposits of loess only in places where there was rain enough to support an abundant growth of vegetation, able to hold all the dust that fell.

On June 21, 1905, I left the main caravan and went down the Sanju valley. Thereafter, in order to cover more ground, Mr. Barrett and I worked independently most of the time, until our final separation in September. Taking a single servant, Ibrahim, and a Khirghiz guide, I rode down the narrow gorge where, as already related, we raced so successfully with the daily flood due to the snow melted by the hot sun on the mountains. We forded the river twenty-three times that day among huge boulders, where the horses con-

tinually lost their footing and almost fell. Once, as we were leading the animals among the boulders at the foot of an almost perpendicular cliff, my horse slipped and fell into the river, knocking me in with him. I seized a big stone and pulled myself out of the swift current, with no mishap beyond a wet note-book and a ruined aneroid. The horse could not land on our side of the river, and had to swim across. It took half an hour to catch him, which greatly disturbed the guide. The road down the Sanju gorge is so difficult that, except when the stream is frozen, caravans follow a circuitous route down the next valley to the east, crossing one of the many "topa," or "earth" passes characteristic of the loess-covered mountain slope. The majority of the valleys leading from the plateaus to the basin floor are even more impassable. Hence the roads from the upper to the lower zones are all difficult, and the consequent rarity of communication accentuates the tendency to diverse development in the plateaus and in the lower zones.

At an elevation of about 8000 feet the Sanju valley broadens, and we there emerged upon a low terrace of loess lying upon gravel, and covered with waving fields of green wheat and barley. The verdure was delightful after the shades of gray, brown, red, and yellow which had wearied us among the barren mountains. At the hamlet of Ulachi, a ragged peasant in a short quilted gown and fur cap made us welcome. The best he could offer us was a place in the large dusky living-room of his flat-roofed mud house. Standing on the ground outside, one could easily look over the roof, but inside, one stepped downward and found that the room had a height of fully six feet. When my eyes had

become accustomed to the darkness, I saw that the room was divided into halves by a depressed path four feet wide, running from the outside door to a store-room, and bordered on either side by posts supporting the roof of reeds and mud. On my side, where there was no furniture save a box, sat the peasant and his three sons. On the other, a young woman, looking like a withered hag, nursed her baby, and a girl, who at twenty was the mother of three children, worked not ungracefully as she sat cross-legged before a wooden spinning-wheel. A third, a girl of fifteen, put weeds on the fire below a big iron bowl of milk; and then cleaned a red earthenware jar, a rare possession, by dropping hot sizzling stones into the water which half filled it. The family ate their supper of hot bread and milk in relays, using a single unwashed wooden bowl and spoon, aided by the fingers. First the two older boys ate; next the father, taking his rosy four-year-old son affectionately in his arms, fed himself and the child alternately; then two demure little girls had their turn; and finally the women modestly retired to the store-room to eat what was left. The peasants' diet, so they told me, is almost invariable, morning, noon, and night, and month after month. Meat, at the local rate of a dollar for a whole sheep, is too expensive to be eaten oftener than three or four days a month. The peasant and his sons care for several hundred sheep and goats, but they all, like the house, the fields, the cows, the trees, and well-nigh the people themselves, belong to a "Bai," or rich man, who lives in Sanju. The peasants have all the milk, and whatever fruit and vegetables they can raise. Half the grain, after next year's seed has been taken out, goes to them

also; but they cannot kill any animals or cut any trees. They seemed desperately poor according to our western standards, but were far from being in want. Like most of the people of the Lop basin, they had plenty to eat, enough to wear, and a place to sleep, and their further wants were few. Later, we met other people who work in the same almost slavish way for the rich land-owners. Though a few expressed mild complaints, the majority of the Chantos seemed entirely satisfied with their lot.

The name "Chanto," or "Chan-teu," as Younghusband gives it, is a Chinese word, meaning "Turban-wearer." It is applied by the Celestials to non-Chinese Mohammedans of the Lop basin, Turfan, and a few oases to the north and east. The Mohammedans, though they belong to a single race and number from one and a half to two million, have no name for themselves other than local designations, such as Kashgari, Khotani, Turfanlik, and so forth, derived from the names of their cities. Nor, so far as I can learn, do the people of Russia, or India, or any neighboring country, except China, have a specific name for them, and one finds no proper designation in books of travel. Their lack of a name, except among their Chinese rulers, shows how little individuality they have as a race, and how their isolation in separate, self-sufficient oases surrounded by vast deserts has prevented the growth of national feeling.

The Chantos, as it seems most fitting to call this nameless people, are generally supposed to be an Indo-European race, closely allied to the original stock from which sprang the races of western Asia and Europe. They have, to be sure, become more or less mixed with various invading

races, Huns, Chinese, Tibetans, and Turks; but the main stock still persists, as appears from Stein's anthropometric observations, and from the general appearance of the Chantos. Their features are large and coarse, but on the whole resemble those of Europeans rather than those of the high-cheeked Mongols or slant-eyed Chinese. Their skins, where not tanned by the sun, are fair, and the children are rosy and often have light brown hair, which later darkens almost to black. The beards of the men are heavy compared with those of the neighboring races, though by no means equal to those of Germans or Englishmen. Ancient tradition relates that the original inhabitants of the Lop basin, the probable ancestors of the Chantos of to-day, migrated from northern India. The tradition is confirmed by the fact that the earliest specimens of writing found in the ruins of the Takla-Makan desert are in the Kharosthi tongue, a language akin to Sanskrit, and spoken in northern India not far from the beginning of the Christian era. Since the Mohammedan invasion of the tenth century, the ancient tongue has been displaced by the Turki language of the conquerors, which is spoken in several primitive dialects.

From the simple, but kindly hospitality of the poor peasants at Ulachi, a day's ride brought us to Sanju, a town of perhaps six thousand people, where Chanto courtesy displayed itself more elaborately. The ride along the fertile loess terraces was delightful. We entirely forgot that the desert lay but a few thousand feet away, at the top of the enclosing red walls of the upper terrace. The narrow ribbon of the green oasis filled our thoughts, and satisfied us with its freshness. Trees and bushes, gardens of vegetables

and gourds, fields of Indian corn and grain, were around us on every side; and the air was full of the delicate fragrance of the yellow mustard fields, or the sweeter, heavier odor of the yellow flowers of the thorny gray eleagnus tree, or Trebizond date. Here, as in all the oases of the Lop basin, the low mud houses stood apart, as they naturally do in a secluded land where war and violence are rare, each by itself in the midst of fields, orchards, and shade trees, and yet none so remote as to be lonely. Only in the very centre of the town, where the weekly bazaar is held, were the houses close together. There the open country lanes, bordered by hedges or low mud walls, gave place for a distance to the typical streets of a bazaar town, dusty alleys between high walls of grayish-yellow mud, pierced every hundred feet by low wooden doors. It is hard to imagine any mode of life more conducive to conservatism and contentment than that of such small oases. Most of the five or six thousand people of Sanju live on their own small farms, and raise enough to support themselves in comfort. No one is poor, and no one is immoderately rich. No one is isolated either socially or physically. The farms are so small that neighbors are always close at hand; throughout the whole extent of the oasis, though it stretches along the river for a dozen miles, one always feels that he is not far from the centre of the village. The contentment of the people is shown by their care-free manner. Though I talked with scores of them freely in their own language, almost no one mentioned his grievances. The Chanto has no opportunity to expand his activities into new fields, and as he is content with his lot, there is nothing within or without to spur him on.

During my stay in the Lop basin, I received the most perfect courtesy at the hands not only of the natives, but of the Chinese officials. On leaving Ulachi, we had not ridden half an hour when we met a horseman, who obsequiously dismounted as we appeared. He bowed almost to the ground and presented a bunch of sheets of red paper, in the midst of which were two other pieces of similar thin red paper, six inches by three, the calling cards of the Chinese "amban," or local governor of Kiliyan, a town and district forty miles to the west, which I did not visit. This official sent his compliments, and a message to the effect that he had sent a present of two sheep, a hundred pounds of grain for our horses, forty pounds of flour, twenty of rice, and four donkey-loads of hay. All this had been despatched into the mountains, but had failed to meet us because we had come by an unexpected route. The messenger, together with the interpreter of another "amban," had been waiting for us nearly two weeks. All the ambans of the region had been advised that two American officials were coming to Chinese Turkestan, and accordingly they were on the watch for us. At our request, the United States Department of Agriculture had commissioned us to collect seeds of grain and other forage plants. Accordingly, we were described in our Chinese passports as American officials. Orders had come from Pekin, so it appeared, that we were to be treated with all honor, and provided with every facility for the prosecution of our work. The Chinese officials carried out the orders most faithfully and heartily, the only partial exception being a peevish official of minor rank at Charklik. His ill-temper was amply excusable, indeed, I ought rather to

say that he was surprisingly good-tempered in view of the indignities to which he had been subjected by the previous travelers, two unrepresentative Englishmen, whose fondness for whipping and browbeating Asiatics may be most charitably attributed to indigestion. Repeated official presents, chiefly of sheep and grain, and formal receptions upon entering and leaving the towns were sometimes embarrassing, especially when we had nothing suitable to offer in return. Nevertheless, the good-will of the officials and their ready help in seeing that we were furnished with means of transportation, supplies, lodgings, and guides, even in the most remote regions, were highly welcome. They never delayed us a day, or interfered with our work for an hour; their coöperation saved much time, and enabled us to accomplish much more than would otherwise have been possible. Chinese officials are often and perhaps justly the cause of complaint, but in many cases the traveler has only himself to blame for his difficulties. I wish to record here my lasting gratitude to the officials of Chinese Turkestan, from Governor-General Oo to merry Emin, the interpreter of Sanju.

A few hours after receiving the message from the "amban" of Kiliyan, we met the Chanto "Beg," or "Lord" of Sanju, and the Dungan, or Mohammedan Chinese interpreter of the "amban" of Guma, the chief town of the Sanju district. With them came eight or ten attendants, mostly chief men of the village, who had ridden out seven miles that morning to meet us. The slender, irascible, bearded Beg in his dark blue skull-cap, bright blue robe, black girdle, and loose red trousers, contrasted strongly with the stout, good-

humored, smooth-faced interpreter, also in a dark blue skull-cap, but wearing a very light blue robe, which half covered his purple trousers, and was itself partly concealed by a black silk waistcoat. The interpreter led my horse to a pleasant group of trees, and carefully turned him so that I might dismount upon some felts spread on the ground. Beside the felts a low platform was covered with rugs, on which stood a little table a foot high and a red cushion on which I was expected to lean. I sat alone on the platform, as etiquette required; while the Beg and the interpreter sat on the felts with Ibrahim, who, being often needed to help me out when my Turki vocabulary failed, was fast acquiring the habit of posing as a man of consequence. The rest of the party, in robes of rusty brown, deep blue, and cinnamon purple, formed a soberer group on the bare earth. Of course we all sat cross-legged, or, more modestly and respectfully, on our knees with our feet concealed as far as possible.

A "dastarkhan," or tablecloth, was produced at once from behind a tree. It is hardly right to call it a "tablecloth," for except in cases of great formality, where foreigners or Chinese are concerned, it is always spread upon the floor. Moreover, the term includes the food as well as the cloth. The "dastarkhan" is the alpha and omega of hospitality in Central Asia, for it always appears as a guest arrives and as he leaves. This first "dastarkhan" consisted of a red tablecloth, showing more signs of use than of washing, on which a servant placed a teapot, and dishes of cold boiled mutton, curdled milk, walnuts, raisins, sugar (which is esteemed a great delicacy), and the dry eleagnus fruit, dusty and tasteless. In addition there were round sheets of bread like

stiff water-crackers, an eighth of an inch thick and over a foot in diameter; other sheets suggested stringy pie-crust; and still others of the same size, though thicker, were bordered by a rim the size of one's finger. This last kind of bread was considered unusually delicious because of the plentiful admixture of sheep's-tail fat and fresh onion stems. Wherever one goes, the "dastarkhan" is sure to appear, which, perhaps, accounts for the sleek, fat appearance of the well-to-do Chanto.

The day after my arrival in Sanju, I wanted to take a quiet ride alone, and accordingly had Ibrahim prepare breakfast at six o'clock. Just as I thought to get away unnoticed, Ibrahim appeared to say that in spite of his protests, the servants were preparing another meal, and the Beg, in whose house I was lodged, would feel much hurt if I did not partake of it. Resigning myself to the inevitable, I sat down at eight o'clock with the Beg to a characteristic Chanto dish of "mantos," balls of chopped mutton, rice, and onions, wrapped in a thin film of dough, and boiled in fat. As the Beg swore at the cook for not preparing the dish well, I felt obliged to eat a good deal to show that it was not so bad. After breakfast, my host announced that he was going to accompany me. "When I have a great guest, can I let him go alone?" he asked when I tried to dissuade him. Five other "honorable" men and some servants came with us, for it would not have been deemed polite to make the party smaller. In spite of the crowd, we had a delightful ride down the river among green fields and scattered trees to the end of the oasis, and then up the steep face of the highest terrace to the omnipresent desert. Here where

the mountains sink into the piedmont gravels, the desert was almost absolute, only a straggling weed or tiny gray bush every two or three hundred feet: the sun was hot and glaring; and the yellow haze, which we had forgotten in the oasis, shut down like a depressing veil, and made us eager to get back to the green strip far below us. I realized why the Chanto has such a predilection for staying at home.

As we looked down from the desert to the oasis, the Beg pointed out the house of a rich "molla," or priest, from Bokhara, who had made a pilgrimage to Mecca. Should we stop there for a cup of tea on our way home? So down we went between ten and eleven o'clock. The pilgrim and I exchanged stories over our tea, for our routes of travel had been identical in many places. As we talked, I watched a dog eating ripe mulberries as fast as the wind blew them from the trees. It reminded me of the beggars in Turkey, who in June and July take up their abode night and day under the mulberry trees, and wait for a living to drop into their mouths. Nearly the same thing occurs in Chinese Turkestan, I found. In the region of Sanju, however, and in other parts of the Lop basin outside of Kashgar, I saw very few beggars; though numerous naked children, both boys and girls, suggest at first sight that the people must be much poorer than is actually the case.

After our bowl of strong, unsweetened tea, I expected to go, but a servant brought plates of sugar, and refilled the china teapots, this time with a most delicately spiced variety of tea. When this was poured into our bowls, our host insisted, just as the Persians do, upon honoring us by adding lump after lump of sugar which we did not want. As

soon as the tea-bowls were empty, a boy with the regulation long-necked, slender-nosed ewer and large basin with a crinkly edge poured water over our hands, the unequivocal announcement that a solid meal was at hand. The Beg and I, on a piazza of mud on one side of a shady little courtyard, shared a huge round platter of "pilaf," or rice, appetizingly cooked with mutton and greens. This the Beg ate skillfully with his fingers, rolling up a ball about an inch in diameter and snapping it into his mouth. The remainder of our repast consisted of a wooden bowl of delicious curdled milk, which the Beg scooped up with a thin sheet of bread. The rest of the party, being of lower rank, sat on another platform on the other side of the courtyard; and the ten or twelve of them shared two platters of "pilaf," the size of ours. They ate rapidly, but not noisily like the Khirghiz. There was no conversation, but once in two or three minutes every one drew back and waited. Then one, followed by another, would wave his hand politely over the dish and invite the others to begin again, and all would fall to. It is not considered polite to talk during meals. The time for conversation is when more important matters have been attended to.

Having had three meals that morning, I was not at all hungry at one o'clock. At that hour, as we were on our homeward way, a galloping horseman shot out of a lane and almost knocked the Beg over. There was a laugh, and an explanation. It appeared that the rider bore another invitation; so we all turned up the lane, "for a bowl of tea." This time there had been less prearrangement. We sat around an empty adobe tank under the shade of the

walnut and mulberry trees shown in the photograph opposite page 146. Tea, both sweetened and unsweetened, was served with walnuts. The chief dish was cold mutton, of which each guest took a bone in his fingers. The amount of bread and meat which courtesy demanded should be placed before the Beg and me was, by careful estimate, between fifty and sixty times as much as we ate.

Judging from my experience that day, the life of the Chantos consists chiefly of eating and drinking. And indeed it does. Except for a poor sort of music and dancing, they appear to have no sources of pleasure except those of the body. Eating plays so important a part in life that the omission of the "dastarkhan" becomes an insult. As I was leaving Sanju in slow procession with all the dignitaries of the town, including a Chinese official on a big gray horse all jangling with bells, the Beg suddenly hastened ahead at a gallop, and a servant cantered away in the other direction. Soon a perspiring footman ran by with a forgotten red tablecloth under his arm; and near the last field a horseman with a steaming teapot dashed past. The cause of the commotion appeared on the edge of the desert, where we found the felts, table, bread, raisins, nuts, sugar, and tea of a complete "dastarkhan."

Having finished the hot tea and said farewell to the dignitaries of Sanju, I rode eastward among the barren foothills of the Kwen Lun range to Puski in the next valley, where I rejoined the main caravan. The scenery was like that of Arizona, low, desert mountains covered scantily with weeds or low bushes of the sage type. The perpetual haze hemmed us in, making everything dull and uniformly

brown or gray in color, and causing the sun, though bright and hot at noon, to fade into a molten ball and finally disappear an hour or more before sunset. Everywhere we found drifts of sand and deposits of loess half dissected by the wind. Evidently, at no remote date this region near the base of the mountains, at an elevation of seven or eight thousand feet, was more thickly covered with vegetation, so that loess could accumulate as it still does three or four thousand feet higher up among the moraines and grassy slopes of what may be called the loess-pasture zone. Within a few hundred or at most a few thousand years, there appears to have been such a change of climate that the vegetation has largely died, and the former region of æolian deposition has been changed to one of erosion.

Puski proved to be like Sanju, a fair green ribbon lying on two low terraces of loess beside a swift stream flowing in a broad flood-plain of cobblestones. On either side rise the low desert foothills; to the south, the mountains rise higher, and the stream is confined to a narrow gorge; while to the north, the vast naked beach of the zone of piedmont gravel slopes gently to the zone of vegetation. It took us a day to cross the gravel between Puski and Zanguya, the first town in the zone of vegetation. We grew sleepy in riding over the hot, monotonous plain. There was nothing to look at except pebbles, wonderfully smoothed and faceted by wind-blown sand, or dense columns of whirling dust, thirty or forty feet in diameter at the base and rising to a height of hundreds or thousands of feet, where they spread out after the manner of thunder-clouds. Twice I counted between twenty and thirty dust-whirls visible at one time, and

there were always at least eight or ten. It was evident that, even if there were no wind, the air in summer would be full of dust continually.

Zanguya is like Sanju, but as it lies about fifteen hundred feet lower, at an elevation of five thousand feet, it proved hotter and less agreeable. It is a typical town of the zone of vegetation, with dusty, shady streets, mud walls, a small bazaar with open shops, many orchards and gardens, and a mild, gentle population. I camped in a garden, and was entertained in the cool of the evening by a group of village musicians, who sang vociferously as they thrummed on preposterously long-necked guitars, which somehow sounded musical though not in tune. A day's journey to the east, we came to Pialma, another village of the zone of vegetation, where I was lodged in the house of the Beg of Sanju, whose guest I still was. From there I crossed the gravel southward to Dua, another beautiful terrace village, and found the Beg himself waiting to give me a last series of "dastarkhans." I explored the Dua valley, which no foreigner had ever before visited, and found that at its head there were thick deposits of loess in the grassy pasture zone, where Chanto shepherds care for sheep, horses, cattle, and yaks.

As we rode eastward out of Dua, all of my escort suddenly dismounted. When I asked if they would like to have me do so too, they seemed much pleased. After walking a short distance, they put their hands together, kicked off their low shoes, and began to pray before a few poles on the top of a bluff, the tomb of a saint. I understood then the reason of our walk of two hundred yards through the deep dust. If by inadvertence I happened to ride past a shrine where the

natives walked, my companions did not object any more than they did if I chose to wear my profane boots close to the holy place; but they always seemed appreciative when I humored their prejudices in the matter of walking.

A long day's journey east of Dua we came to Pujiya, another terrace village at the foot of the mountains. Some distance from the oasis the local headman met us with at least a dozen men and horses to help us across the broad, deep ford of the Karakash River, whose various branches spread over a rocky flood-plain nearly two thousand feet wide. He would not be satisfied until I mounted what he considered the safest horse; and then he wanted two men to lead it. I allowed this at first, but it was too ridiculous, so I sent the men back, much to the regret of the young Chinese interpreter who had been deputed to accompany me. If my horse was not led, etiquette would not allow his to be. In a shallow place in the middle of the river he let his horse get too near another, the two began to fight, and the interpreter — blue gown, fan, and all — rolled off into the muddy torrent. Later, when we reached the village, it appeared that we were to encamp in a garden surrounded by a high mud wall, and entered only by a low door. The headman was so anxious that I should ride all the way to my resting-place that he had ordered part of the wall to be torn down, and through the breach he led my horse triumphantly to the felts on which I was to dismount.

When, from the same village of Pujiya, I rode a little way up into the unexplored gorge of the Karakash, my guide and I overtook two men a mile or two out from the village. One carried a dripping bag of curds, the other a wooden

bowl and a black copper teapot. After we passed them, they kept running to overtake us, and seemed determined to keep with us. Five or six miles out, they sat down to wait, while I walked up a precarious path in the gorge. On my return, they offered me a refreshing drink of curdled milk and water, and some apricots. By order of the headman those two men walked ten or twelve miles in the hot sun to render this small service. The next day, when I left Pujiya, the two men shown opposite page 150 suddenly appeared in the desert six or eight miles from the village, and began to run before us. One balanced on the tips of the fingers of his left hand a wooden bowl of the inevitable sour milk, which, by the way, most travelers find both wholesome and palatable, when once they learn to use it. In his right he held a teapot filled with water, a china bowl, and a wooden spoon. The other bore in either hand a platter of apricots and of mulberries. They had been ordered to run a mile or two farther in the hot summer sun to the top of a pass. We stopped, however, as soon as we found some shade at the foot of a cliff. In both these cases, two men had been detailed to do what could have been done by only one or by my guide. The prevalence of such needlessly courteous customs would be impossible if a low standard of living and cheap food did not give the people abundant leisure, and if the Chantos were not so abjectly submissive to every form of authority.

The submissiveness of the Chantos is largely the result of cowardice, and this in turn is probably due in great measure to their isolation by mountains and deserts. The untraveled headman at Pujiya trembled visibly when he

thought I was not pleased with the trees under which he spread the first "dastarkhan," yet the same man spoke most peremptorily to his fellow villagers, many of whom honored him by jumping off their horses on his approach, and bending forward with their hands crossed over their stomachs.

CHAPTER VII

AMONG THE CHANTOS AT THE BASE OF THE MOUNTAINS

FORTY miles northeast of Pujiya lies the large and fertile oasis of Khotan, with a population of perhaps a hundred and fifty thousand people. On the night before my arrival, an official interpreter in a dark blue jacket and skirt came out to the cool native house where I was quartered, and asked me to set out late the next morning. There was much excitement as we got ready to start; my men put on their best clothes; and three or four local officials clad in silk and mounted on horses which put ours to shame accompanied us. Five miles from the bazaar at the centre of Khotan a crowd of fifteen horsemen appeared, and when we came up dismounted, as did the six or eight men with me. I was about to do likewise, when Rasul called out in English:—

"No, no! You staying on horse. You big man to-day. These all little men. Every time to-day you *must* staying on horse."

The men were merchants from India, who regard a white man from that country as a friend and protector. We shook hands all around, and cantered on, a company of twenty-five. Two miles from the bazaar, an official in a mushroom hat with a big red plume met us, and asked us to stop a minute under the trees. There was the sound of great confusion around a bend in the road just ahead. When a signal was given, we moved forward, and found beyond the bend

a hundred soldiers in gaudy red and blue suits marshaled in two lines on either side of the road. Every one else dismounted, but I knew that I "must staying on horse." As I advanced between the lines, the soldiers stood at attention; triangular red dragon-banners were waved; six-foot trumpets brayed; and my horse jumped at the sound of a salute of great cannon crackers. Across a little bridge over a muddy irrigation ditch three blue-topped, two-wheeled carts came to meet me, followed by forty or fifty Chinese officials and military officers, all in blue, and many with huge smoke-colored goggles. I met the first cart at the head of the line of soldiers. As it stopped, I dismounted from my horse, while the governor, with the button of a high mandarin in his hat and a beautiful silk dragon on his breast, got out of the cart. We feelingly shook hands with ourselves, bowed low again and again, and said many sweet things each in his own language. Then he took me gently by the hand and led me to a little red pavilion erected for the occasion by the roadside. There, with two mandarins from the other carts, we drank tea and tried to talk. I spoke in one dialect of Turki or in English to Rasul, he in another dialect of Turki to the official interpreter, and he in Chinese to the governor. The conversation was undeniably diluted, but as Rasul put it: "You plenty sweet matter telling to governor. I think he liking very much. You making talk to soldier-man very good. Yes, that was very best. All men very pleased." He himself had suggested that I thank the soldiers as well as the officials for coming out to meet us. As we rode to our quarters in a shady pavilion surrounded by a moat in the centre of a large garden, the attendants pointed out parts

of the road where "the crooked had been made straight, and the rough places plain," in honor of the governor's pilgrimage to meet the foreigner.

I shall not attempt to describe my two weeks' stay in Khotan. Other travelers have told of the crowded weekly bazaar, the good-natured people, the Wednesday festival in honor of the life-giving river, and the houses, dress, and manners of the Chantos. Nor is it necessary to tell of Chinese official dinners with over thirty courses, of all of which I partook, including fat fish-skin, rotten eggs, and green algæ from the rice-fields. I was impressed by the strength and civilization of the Chinese, and by the similarity of their attitude toward the Chantos to that of the English toward the people of India.

After Mr. Barrett's arrival in Khotan, we returned almost to Pujiya, and betook ourselves once more to the mountains, among the semi-nomadic people of the pasture zone, who live in tents or in caves of loess. On August 5, twelve days after leaving Khotan, we crossed the Yurungkash River near Nissa, on the rough, loose timbers of the only bridge within hundreds of miles, and climbed in a heavy rain to a wonderful upland. The next day was remarkably clear, and as I stood there on the soft, green, loess-covered slope of the Pisha basin, 14,000 feet above the sea, I saw at a glance the lofty mountains bordering the plateau, the pasture zone, the desert mountains among which lie the terrace villages, and the deserts of gravel and sand whence comes the haze. There was no life or movement, save where a flock of black goats and brown or white sheep were herded near a felt tent far down the gentle incline of the verdant mountain

side. Not a tree was in sight. There was a delightful sense of freedom and exhilaration which was accentuated by the rare purity of the air and the glorious view of the magnificent mountains surrounding Pisha on every side.

Every sharp peak, gleaming crest, and blue-shadowed glacier of the snowy Kwen Lun range to the south stood out with cameo distinctness, though the mountains, from 20,000 to 24,000 feet high, were twenty-five or thirty miles away. Westward I looked down 7000 feet over grandly buttressed walls of naked rock into the unknown canyon of the Yurungkash River, narrower and deeper than the famous canyon of the Colorado. It separated the west side of the Pisha basin abruptly from a veritable maze of deeply gashed, naked mountains, the remnants of a dissected plateau. To the north, an opening in the mountains disclosed the yellow line of haze above the sandy desert sixty miles away, near Khotan; while to the northeast, the huge flat-topped bulk of the isolated Tikelik plateau, 19,000 feet high, obscured the view of the basin floor. Still farther around to the right, fair, green pasture slopes, the gift of the loess, fell off, at what seemed by comparison a gentle grade, to the half-naked red and brown outcropping rocks of the centre of the Pisha basin at a height of 9000 feet, and then, twenty-five miles away, rose again to 16,000 feet in the rounded peak of Khan Ileseh, connecting the outlying plateau of Tikelik with the main range of Kwen Lun. During the morning, every detail of the magnificent view was clearly visible. At noon, however, when a strong south wind gave place to the usual afternoon breeze from the north, a change took place, and the process of the deposition of loess was vividly illustrated.

The yellow band of haze, far away to the north behind all the mountains, had already expanded to a veil with a definite top, at the height, presumably, where the convectional currents of hot air rising from the desert had become so cooled by expansion that they spread out into a sheet at a position corresponding to that of the top of a thunder-cloud. Now the veil came slowly toward us, filling the lower gaps at first, and pouring into the Pisha basin, though the surrounding mountains and the sky still remained clear. By two o'clock, the dust had been wafted upward so that the dark Tikelik plateau was hazy; and by four, even the highest of the white mountains to the south were dimmed.

During the two succeeding weeks, which we spent in the Karatash valley east of Pisha, the air was thick with haze most of the time. Dust fell so fast, that even on a still day one was obliged to brush his letter-paper every ten or fifteen minutes to prevent the pen from becoming clogged. Almost every traveler speaks with exasperation or weariness of the persistence with which the haze shrouds the land for weeks at a time. I often felt as if my eyes were covered by a veil, which must somehow be torn off, or else I should drop into the apathetic mood of the natives. It would be rash, perhaps, to say that the apathy of the people, and their lack of curiosity and initiative, are due in any degree to an atmospheric haze. Nevertheless, when the traveler finds that this same haze tends to induce these qualities in himself, it is reasonable to question whether its continual influence upon generation after generation of Chanto natives may not, unconsciously to them, have been a factor in molding their character. Now they have reached a point where they are

even more apathetic than most Orientals: a dull day is scarcely noticed; a clear day inspires them but little; every vicissitude of life is received quietly; and nothing moves them greatly from the even tenor of their way.

The people of the Karatash valley are shepherds at the upper end, gold-miners in the middle, and farmers lower down, below an elevation of 8000 feet. The gold occurs in the gravel of terraces, just as in California. The cut (page 76) shows how the women and children bring the gravel in bags on their backs to the stream, where it is "panned" by the men in subconical wooden bowls eighteen inches in diameter. The man in the photograph told me that the sluice where he was working was the common property of twelve men, belonging to five or six families, every member of which, from six years old upward, is engaged in the work. The men own a few fields, but by no means enough to support their families. Their only live-stock is a few donkeys. The profits of the united labor of the twelve and their wives and children during the preceding month had amounted to two hundred "tengehs," or ten dollars, and during the month before that to eight dollars. According to the Chinese regulations, all the gold must be turned over to certain native officials, who pay for it what they choose, often only half the real value. The slight return from gold-mining is credible only when one sees the clumsy method of work, the frequency with which a pan of gravel yields nothing, and the deliberation of the movements of the miners. Yet, with the help of their fields, the people manage to live on a dollar a month for each man and his family.

Below the gold-mining district, we found along the Kara-

tash River a narrow strip of green fields between precipitous red walls, and there we encountered the first of the famous Mohammedan shrines of Central Asia, a group of votive poles bearing flowing yak-tails, sheep-skins, horse-tails, and streamers of cloth, after the Buddhist fashion. As we approached the shrine, Akhmet, the servant who was with me, became visibly excited. With flushed cheeks he said to the guide: —

"Tell me a long way before we reach the shrine, so that I may be sure to dismount in time."

A quarter of a mile away, after offering a prayer, he began to walk; and at two hundred feet from the mud wall enclosing the shrine — an unusual feature — took off his shoes and prayed again. A sheikh, or priest, appeared.

"Can one buy a sheep here?" demanded Akhmet eagerly.

"No, there are no sheep: they have all been driven up to the head of the valley; but there are some goats."

"Very well, bring me a goat, and bring it quickly."

In his fervor, Akhmet did not even ask the price of the animal, although usually he was a keen bargainer; and later, when I offered to pay for it, he said: —

"No, this is a sacrifice. I must pay for it myself."

With surprising speed, two sheikhs, the one old, wizened, and miserly, the other middle-aged, fat, and gluttonous, brought a goat, together with wood, water, fire, and a huge iron kettle. All the able-bodied men in the vicinity found out what was going on as if by magic. Within an hour and a half, they had killed, cooked, and eaten the animal; its horns and skin had been added to the trophies hanging

from the bean-poles of the shrine, and the last prayers had been said. Akhmet told me that he had prayed for himself, his family, his "Sahibs" and their work, and all his friends. The effect on him resembled that of the traditional old-fashioned revival. He was very good for a few days, very ready to do more than was required of him; but he was also more inclined to parade his religion; and there was a shining of the eyes and an air of forced humility, which plainly showed that he felt himself to have been elevated above the plane of ordinary mortals. On the whole, I believe that the experience did him good.

In Central Asia, a shrine is almost invariably located near a ruin; and so it was in this case. Choka, which I discovered a few miles below the shrine, is the ruin of a walled town, which must have had a population of from three to five thousand souls. It dates from about the time when Mohammedanism superseded Buddhism, in 1000 A. D. The ruins have a length of half a mile and a width of a quarter. They lie at an elevation of about 7500 feet, on a flat gravel terrace in the sharp angle between the Karatash River and the Choka brook; and are elevated from two hundred and ten to two hundred and fifty feet above the river. Evidently, the site was selected from a military point of view. It is surrounded on three sides by almost perpendicular cliffs, utterly inaccessible except at the northern end, where a massive wall protects the main approach to the town. At the southern, exposed end, the town was protected by a double wall and moat.

According to the natives, the water supply of the ruins came from the Choka brook, flowing under the ground in

the stone troughs of which pieces have been found. To-day, the brook is too small to supply so large a town. The water supply cannot have come from the Karatash River. To bring it to the ruins, two hundred and fifty feet above the stream, would require a winding aqueduct ten miles long, cut much of the way in the face of almost perpendicular cliffs of red sandstone or of gravel, and carried across the mouth of at least one large tributary gorge. Such a piece of work would be out of all proportion to the size of the town, and would be an engineering feat utterly beyond anything, old or new, known to exist in Central Asia. Moreover, if such an aqueduct had ever existed, some traces of it would surely remain, and would be known to the natives. To bring water from the Choka brook, on the other hand, would be an easy matter. The bed of the brook rises rapidly up the valley; the cliffs soon die out; and within three miles of the ruins, water could be led out of the brook and brought to the ruins by means of a simple ditch. The difficulty is that at present the Choka brook suffices for only twelve families of peasants. A little water runs to waste in summer when the snow is melting on the Tikelik plateau, but in spring every drop is needed; and in winter the brook is said to dry up completely except for a few small springs.

Since the water supply of ancient Choka cannot have come from the Karatash River, only two alternatives remain: either the Choka brook was once larger than it now is; or by careful management a little stream, which to-day supports a dozen families of peasants, was made to support fifty times as many families of townspeople, who, of course, would require much less water per individual. The second

alternative seems incredible, especially when the scarcity of water in winter is considered, but it is impossible to speak positively. It is scarcely probable that with the Chira, Genju, and Pisha rivers close at hand, any government would have chosen to build the chief walled town of the district on a little brook, which, under the best of circumstances, could provide barely enough water for drinking purposes. There is no ground for supposing that part of the brook has been diverted, or that it has grown smaller for any reason other than change of climate. If the climate was somewhat moister, and the brook larger, all difficulty disappears.

The hypothesis of climatic change explains another point. If conditions were as they are to-day, it is remarkable that so large a town should have grown up in this remote spot among the mountains. The population from Pisha on the west to Imamla on the east — the district which is naturally tributary to a market town located at Choka — amounts to-day to less than five thousand people. It could not be greatly increased without the adoption of irrigation methods far in advance of any known ever to have been practiced in Central Asia. The present bazaar town of Chaka, northeast of Choka, has a population of about three or four hundred directly around the centre, although as the weekly bazaar was revived only ten years ago, the number may increase somewhat. A town like Choka, with from three to five thousand people, seems disproportionately large as the centre of an outlying district with a population scarcely twice as great. If, however, the climate were more propitious, the possibilities of irrigation would increase; and the pasture zone upon the loess deposits would be increased

much more. Nomads might become numerous, and the total population might be several-fold larger. It is probable that such was the case. From Khotan eastward we heard frequent mention of the "Kalmucks" or Mongol nomads of Buddhist faith, who appear to have once lived in considerable numbers along the base of the Kwen Lun mountains. A road almost unused, and running for hundreds of miles along the base of the mountains, is always called the "Kalmuck road," and appears to have been formerly more frequented than now. At present, though every available spring and stream is utilized, the population is extremely scanty. There seems to be a general impression, however, that some hundreds of years ago, in the days of the Mongols, the population was greater, and this means that the water supply was then greater also.

A few miles north of Choka, I discovered the ruins of Karaki, or old Hasha, a close reproduction of those of Choka. They are only a sixth as large, and partake far more of the nature of a fortress than of a town. The natives have no idea as to whether the water supply came from the Karatash River, a hundred and fifty feet below on the east, or from the brook on the west. The latter is said to be dry except during rain. Here, as at Choka, we are confronted by the question whether the water supply came by an impossibly elaborate and completely vanished aqueduct from the red-walled gorge of the river, or by an easy ditch from the dry brook. There is the same scarcity of pottery as at Choka; and the people say that nothing of value has ever been found, though they and their ancestors have dug among the ruins in every direction. The fortress

must have been inhabited a long time, for the people keep a donkey-road in repair for the sake of carrying away the soil enriched during the abode of man. The marked similarity of location and plan between Choka and Karaki suggests that they were contemporary. If this is so, the probability that the population was formerly more dense in this region is increased.

Before finally leaving the mountains, I made a détour eastward to Imamla, a terrace village, and Polu in the pasture zone, returning again to Choka. Imamla is the seat of a famous shrine, and I was anxious to visit it because I had heard that the sheikhs had a "tezgireh," or chronicle, relating the history of Choka. I went to the house of the chief sheikh, a most unpriestly young man, with a merry boyish air and two or three wives. As befitted so religious a house, the call to prayer or some one of the five daily prayers seemed to be in progress most of the time. Even the beggars attached to the shrine would pray for five minutes if one gave them a penny. Whenever one of the other five sheikhs came to call, he said, "Salaam," and at once opened his hands in prayer; and of course there were long prayers at meals. One might have thought himself in a monastery, if women had not passed through the courtyard now and again.

The chronicle, which was owned by the sheikh, is said to have been written by one of the scribes of Yusup Khadir Khan Khazi, king of Kashgar in 1000 A. D., at the time of the death of the Four "Imams," or "Saints," from whom the shrine takes its name. The Imams, so the chronicle says, came with the other Mohammedan invaders to convert

Khotan. As the Khotani "infidels" clung to the Buddhist faith, the four saints by power of prayer destroyed their city, then called Khal-khalimachin. Thereupon twelve thousand people became Mohammedans, and built the new city of Khotan. Of the remaining pagan inhabitants, seventeen thousand, with Nuktereshid-Chuktereshid, their king, came to Choka, and built the city whose ruins I discovered. Forty years later, the Imams followed them, and naturally were refused admission. A man of Choka, however, who had secretly become a Mohammedan, came out by stealth, and led them to the water supply of the city. As the water flowed in an underground conduit, its exact course was not evident. The Imams prayed for guidance. At once a tree sprouted, grew to maturity, flowered, and produced fruit, a delicate red crab-apple peculiar to the terrace villages. Knowing that the tree must grow from the water, they dug a hole, and found the conduit, and dropped into it a red crab-apple. The apple swirled round and round in the swift stream, and finally was sucked downward. Thereupon the water dried up. The city was forthwith abandoned, the people moving on eastward through Sai-Bagh and Nura to Imamla on the Ak-Sai River. Thither, in course of time, the zealous Imams followed them for the final combat. The pagan king was encamped higher up the Ak-Sai than were the few Mohammedans, and the water which came to the latter was polluted. The Imams dispatched a pious subordinate, whose fervent prayer caused the Ak-Sai to be diverted eastward into the Kara Su, where part of it still flows. This did not quench the ardor of the pagans, however, for soon after, when the Mohammedans

were at their prayers, the host of Nuktereshid fell upon them and killed them all, including the Imams. Forty, however, came to life again, and returned to Kashgar. They persuaded the king of that country to send some families, who settled Imamla, Sai Bagh, and Nura, which till then had been inhabited only by nomads. Nuktereshid and his people moved on southeastward to Polu, which is said to have been an important post, "because it lies on the Kalmuck road from Yarkand to Cherchen." There they were finally conquered by the Mohammedans.

The whole story is full of fantastic miracles and impossibilities, but the main facts are historically accurate. The miracles, such for instance as the diversion of the Ak-Sai, are chiefly distorted explanations of real facts. The dates are open to question, for while the chronicle gives 1000 A. D. as the time when Nuktereshid ruled, Bellew gives 1095 A. D. Apparently, Choka was a provincial town in a district inhabited by nomads, and rose to importance only during the brief space when it became the capital of the Buddhist kings, whom the Mohammedans expelled from Khotan about 1000 A. D. The abandonment of the town was traditionally a withdrawal of the people without fighting because their water supply failed. Of course the water supply may have been diverted by an enemy, as is said to have been done in the case of the Ak-Sai; but that does not explain where the water went, or why a town was ever founded with so diminutive a water supply as that now available, unless the climate were different.

The story of the miracles suggested to me to ask whether there were any "jins," the genii of the Arabian Nights, in

the region. The sheikh whom I addressed looked sheepish; the bystanders laughed, and some one said:—

"Oh, yes, he knows how to drive them away. There are many here, not only in the mountains and the desert, but in the village. Look at that man. A 'jin' struck him. Can you heal him?"

The man referred to suffered from a large excrescence on the side of the head above the ear. In Khotan and Yarkand, where the people suffer terribly from goitre and stiff necks, it is commonly believed, so I was told, that the ill-natured "jins" have a habit of gripping a sleeping man around the throat, after which the neck swells with goitre. Sometimes the "jins" vary their mischief by cuffing the side of a man's head, causing a stiff neck.

The four Imams who died so sadly at Imamla must have been well-to-do, to say the least. According to the sheikhs, they cooked their rice in a golden pot, which is still preserved in a rickety mosque, and is used for cooking the sacrifices of pilgrims. The pot is so holy that whoever looks at it is struck blind. I naturally inquired how, then, the meat could be cooked.

"Oh," answered Kassim Sheikh, my host, "when a sheikh becomes sixty years old, he can see the pot without injury. Even I have never seen it."

Later, I had a conversation with the old sheikh who acts as "chef of the golden pot," but refrained from asking questions. He looked like a man able to keep a secret.

An equally remarkable fact was brought to light when I sought for geological information. On asking the source of numerous cobbles and small round boulders of vesicular

black lava in the flood-plains north of Imamla, I was told that they were the brains and skulls of the infidels who were destroyed in the great hurricane which arose after Nuktereshid-Chuktereshid killed the four Imams. I eventually found their origin in some lava flows of the glacial period interstratified with piedmont gravel.

While we were at Imamla, the men again offered sacrifices. Five or six pilgrims were there at the time; and a thousand are said to come in the course of favorable years, in spite of the remote location. One was a highly intelligent, well-dressed man, originally a merchant of Yarkand. In his youth he went to Mecca, where he settled for twenty years: now he was on a money-making tour of the shrines of Central Asia. His sanctity as a resident of Mecca, and as a visitor at many shrines, entitled him not only to the richest entertainment, but to lavish gifts. He attached himself to me for a day, and that night I heard a village headman give orders for a gift of supplies of all sorts to be made ready for his journey.

CHAPTER VIII

THE SAND-BURIED RUINS OF CHIRA

WHEN I returned from Imamla to the Karatash valley it was almost the middle of September. The hot summer was over, and it was time to go down to the zone of vegetation and the sandy desert of Takla-Makan. So I rejoined Mr. Barrett, and together we traveled down the Karatash River to Chira, a prosperous town of about ten thousand inhabitants. Here, as everywhere in the zone of vegetation, most of the people are farmers. One rarely sees finer fields or better fruit than those of Chira. Luscious little white peaches, dark crimson nectarines, grapes of various sorts, melons that melted in one's mouth, and delicious watermelons, both red and yellow, could be bought for a song. The air was so dry that one could indulge in them freely without harmful consequences.

At Chira, Mr. Barrett and I, having finished our work together, undertook separate expeditions. He devoted his attention chiefly to the physiography of the mountain border of the Lop basin; I mine to a study of the climate of antiquity. The best point for beginning my investigations seemed to be a group of ruins, Uzun-Tetti and others, which lie in the zone of vegetation a few miles north and east of Chira, and another group, Dandan-Uilik and Rawak, which lie far out in the sandy Takla-Makan desert, fifty or sixty miles north of Chira. Stein, the only archæologist who has visited the region, describes Dandan-Uilik, the chief of the

ruins, as having been a large town with several religious establishments, either Buddhist lamaseries or temples. It was situated in the midst of an oasis, called Li-sieh, or Litsa. A considerable agricultural population was settled round about, as is shown by numerous remains of ancient irrigation works. Rawak, the more northerly town of the Litsa oasis, was probably abandoned about 300 A. D., while Dandan-Uilik itself, to judge from the evidence of manuscripts found in the houses, does not appear to have been finally deserted until a little before 800 A. D. "But," as Stein says, "the striking preponderance of religious buildings . . . suggests the possibility that these local shrines and their small monastic establishments continued to be kept up and visited, perhaps as pilgrimage places, for some time after the rest of the settlement had been abandoned. The condition in which Mohammedan Ziarets [shrines] are now often found beyond the present cultivated area of oases would furnish an exact parallel." Stein concludes that "the lands of Dandan-Uilik were irrigated from an extension of the canals which, down to a much later date, brought the water of the streams of the Chira, Domoko [properly Dumuka], and Gulakhma to the desert area due south of the ruins . . . [where] the débris-covered site of Uzun-tati . . . can be proved by unquestionable evidence to have been occupied for at least five centuries longer. . . . A number of historical as well as topographical observations . . . point to the conclusion that the successive abandonment of both Dandan-Uilik and Uzun-tati was due to the same cause, the difficulty of maintaining effective irrigation for these outlying settlements." Hedin, on the other hand, believes that this can-

not be true for Dandan-Uilik and Rawak, of which he was the discoverer; they must have received water from the Keriya River, which now flows twenty-six miles east of the ruins, but in ancient times, so he supposes, was diverted to the west. I hoped to be able to find conclusive evidence as to the truth of one or the other of these two conclusions. Also, if Stein proved right, as there was reason to expect would be the case, I hoped to determine whether the manifest drying up of the streams or canals which supplied the ruins was due to human causes, such as war or the decay of irrigation works, or to physical causes, such as a change of climate. My investigations confirmed Stein's conclusion, and showed that the water supply throughout the whole region was formerly more abundant than now, and hence that in ancient times the climate must have been different. An account of my journey into the desert will show the reasons for this conclusion, and later I shall discuss the matter more fully.

At Chira, when I inquired for a guide, every one said, "Oh, Ibrahim Beg, the Master of Canals, is the man you want. He went with the other Sahib [Stein], and he knows all the ruins everywhere." So I sent for Ibrahim Beg, a conceited little man, with the face of a humorous Irishman. He came in his official uniform, and professed to know far more than I could possibly want. We tried in vain to hire camels at Chira, and so went eastward a few miles to Dumuka, a neighboring village, to try again. There, as at Chira, the camel owners said that all the animals were up among the mountains in the summer pastures. No one hesitated to promise to send for camels to be brought down at once, but it was clear that no one meant to do so, for fear

that in the sandy desert the creatures might suffer from hunger and thirst. It looked as if we should fail of our purpose, and I determined to buy my own camels at the next opportunity in Keriya, no matter what happened. After a long conference with the Beg and various men of influence that day at Dumuka, I went to bed with my mind made up to a delay of at least three or four days. In the morning, however, I heard camel-bells, and went out to find seven good animals grazing on the poplar trees. Da'ud, one of my Chantos, had heard that a small caravan from the mountains was expected to pass that night, for men with camels do not travel by day in warm weather. He went out to the main road and waited till midnight, when the caravan arrived and he corralled it. We sent post-haste for the owners, who arrived that afternoon. In view of the fact that we had "nine points of the law," they let us have the camels for a good stiff hire. When we returned with the animals safe and sound, some two weeks later, they expressed themselves as well satisfied with the bargain.

From Dumuka I sent the horses and my two Ladakhis, Ibrahim and Abdur Raman, eastward to Keriya. There they were to buy five camels, and have everything in readiness for a fresh start when I arrived two or three weeks later. I myself, with Da'ud, Ibrahim Beg, a camel-man, a camel-boy, and the five hired camels, proceeded toward the desert. We spent the first seven days in circling about in the zone of vegetation. Within a few miles of Dumuka, along the north and south line of a former course of the Dumuka or Ak-Sai River, I discovered the waterless, sand-buried sites of four small villages, evidently the ancient Buddhist equi-

valent of modern Dumuka. The southern site, called by my guides Derevzeh Dung, is unimportant. It occupies nearly the same location as Stein's small Aktaz, with which it is probably identical. At the next site, Kuk Jigdeh (Green Eleagnus Tree), as well as at Kushkusteh Dung, the one farthest to the north, we found some little clay heads of Buddha and some plaques with typical Buddhist figures, which show that the sites antedated the Mohammedan conquest in the tenth century. The other site, Khadaluk, appears to have been the centre of the old town. In two places we found abundant votive tablets with heads of Buddha, and many fragments of painted plaster and gilded stucco, evidently the remnants of an old lamasery or temple. Apparently here, as at Dandan-Uilik, the most permanent structures, and probably the ones last to be abandoned, were of a religious character. We also found several Chinese coins, dating from early in our era, some fragments of paper bearing records in Brahmi script, and two pieces of wood covered with the characteristic Kharosthi script of the first three centuries of the Christian era. One of these (B, in cut, page 204) bears on the reverse side paintings of a camel and other objects. Evidently, the four sites just described are parts of an agricultural district at least four or five miles long, and quite as large as modern Dumuka. The final abandonment of the ruins certainly took place before the Mohammedan conquest in 1000 A. D., and perhaps earlier.

About eight miles north-northwest of Khadaluk, at Payet-Begning-Ilesi or Tetti-Gerim, I discovered another little site, with remains of tamarisk-walled houses, abundant crude pottery, a few beads, and a bit of blue glass, but

with nothing by which to date it. The general appearance, the aggregation of the houses, and the condition of the surrounding vegetation suggest that the site is at least as old as Khadaluk.

Farther west, the ruins of Uzun Tetti and Ulugh Mazar proved to be more extensive than appears from previous explorations. From the shrine of Lachinata for five miles to the northwest, to Ulugh Mazar, and thence six miles farther to the northeast, I found abundant pottery. There were also other relics of human occupation, including the traces of a mud house, the straw of an old threshing-floor, and even the characteristic pattern of the ditches of ancient melon fields. The entire appearance was such as to suggest that the site was not abandoned till a later date than Khadaluk. The pottery also pointed to the same conclusion, for unlike that of more ancient sites, it was wheel-made, the ornamental designs were drawn in curves with a stick of several points, and one bit had a green glaze. This conclusion is confirmed by the historic records of the Mohammedan conquest, and by some coins of the twelfth and thirteenth centuries which Stein found at Ulugh Mazar. It appears that at the time of the Mohammedan conquest, and later, not only was Chira inhabited much as it is to-day, as is proved by early Mohammedan records, but that here, twelve miles to the north, along the line where the Chira River would flow if it were large enough, an equally large area, about six miles by eight in size, was also densely populated.

From Ulugh Mazar I came back almost to my starting-point, and spent a day with the Beg of Malakalagan, the northern part of Dumuka. A short distance north of the

Beg's house I had seen the ruins of a large village, which evidently had been abandoned recently. The Beg told me their history substantially as Stein has recorded it. Formerly, the villages of Dumuka and Ponak were located eight miles north of the present sites. About 1834, the water supply began to run short, being lost in the sandy jungle above the village. It diminished so greatly that for seven years no water reached the canals during winter. The people were obliged to dig wells. Finally, the scarcity of water became such that distress ensued from the failure of crops. The villagers decided to abandon houses, fields, fruit trees, vineyards, and everything, and move eight miles upstream to a new site. The disadvantages of poorer, sandier soil and of the loss of the labor of years were more than compensated for, they felt, by the greater proximity to the springs where the water from the mountains reappears after its underground course through the piedmont gravel. Each proprietor was given the same amount of land as formerly in a corresponding location, and with it a proportional quantity of water. Chira and Gulakhma also suffered at this time, though much less. Nearly eighty families moved up to Ekken, a very sandy site close to the springs of another stream. There can be no doubt of the authenticity of this account, for Ismail Beg, the relater, heard it from his father, who was among those who moved; and some of the old people of Dumuka still remember the event. Since the occupation of the new site, no special difficulty as to the water supply has been experienced. Indeed, between 1893 and 1900, it actually increased. There was so much surplus water that the hamlet of Malakalagan was founded by

people from Dumuka, who cultivated fields in both places. In 1900, the population amounted to twenty-five families; but since then the supply of water has again decreased, part of the people have gone back to their old homes, and the cultivated area has diminished from three thousand to fourteen hundred "mulaks."

In answer to my further inquiries as to the history of the region, Ismail Beg sent for a "tezgireh" like that of Imamla, a dull, but apparently accurate contemporary chronicle of the Mohammedan invasion. It is written in the Turki language in monotonous couplets, of which the following is a sample, with a translation in the same metre: —

"Láchináta yúrdilér,
Kéya [Keriya] déyasi géldilér."

"Láchinata conquered, they
Kéya-ward pursue their way."

The chronicle describes how, in the tenth century, the Moslem invaders advanced along the line of oases from Kashgar through Yarkand and Khotan to Keriya. They killed some of the Buddhist "Kafirs," or "infidels," converted others, and caused the rest to flee north across the desert. Chira is described at length with reference to local sites well known to-day, so that we may assume it to have been much the same as at present. Having conquered Chira, the invaders sacked Lachinata and Ulugh Mazar, or Terkhi Turkhan and Kenan, as they are also called. Of the inhabitants of Kenan, which is said to have been a city with a gate of gold, two hundred and forty-one adult men were killed, and five or six hundred became Mohammedans. If Lachinata were equally large, as appears from the ruins, the

combined population of the two must have been about equal to that of modern Chira. The chronicle does not mention Dumuka and Ponak, but there is a local tradition that their Buddhist inhabitants fled from the Mohammedans and went northward down the Keriya River to Ak Su, crossing the Takla-Makan desert where now there is no water and no road. As to the other chief village of the region, Gulakhma, between Chira and Dumuka, tradition says that it has occupied the same location from time immemorial. As it occupies the site where the waters of its river can most easily and with least waste be utilized, and as there are traces of ruins in the suburbs, there is no cause to doubt the tradition. Choka, on the upper part of the Karatash River, which waters Chira, was inhabited at this time, it will be remembered; and we have seen reason to believe that the slope of the mountains whence flow the rivers of Chira, Gulakhma, Ponak, and Dumuka was then occupied by a population of Kalmucks, more numerous than that of to-day. Thus it appears that about 1000 A. D., not only was the total population supported by the rivers larger than it now is, but the streams flowed through the modern villages, where their water is at present entirely consumed, and reached places like Ulugh Mazar, ten or fifteen miles farther north. This could happen only if the rivers were decidedly and permanently larger than now. There has been no diversion of the upper waters of the rivers except in the insignificant and easily preventable case of a small part of the Ak Sai or Dumuka River; and there is not the slightest evidence that the irrigation system of the past was better than that of to-day. The true cause of the

diminution of the water supply appears to be that the climate has changed.

It is proverbially unsafe to place much reliance upon legends. Students, however, are more and more recognizing that legendary stories contain a kernel of truth, which can be detected by comparing scientific facts with those details of the stories which would be least likely to be the product of imagination. Therefore the local legend of the destruction of Kenan or Ulugh Mazar is worth recording. According to Ismail Beg and the people of Malakalagan, a holy Mohammedan priest came to Kenan one day, long after the driving out of the former Buddhist inhabitants, and found no one at home. Men, women, and children had all gone out to work on the canals. The holy man was hungry and tired. Being accustomed to live on the fat of the land, he was irritated at finding the houses shut and empty. He offered a prayer, which can hardly be supposed to have been pious, and began to turn a hand-mill standing in a courtyard, whereupon sand rained down from heaven. It ceased to fall when the troubled villagers, having seen it from afar, came hastening home and supplied the good man's wants. Nevertheless, the visitation proved fatal. From that time onward the water supply decreased, until at last the people of both Lachinata and Kenan abandoned their houses and fields, and moved to old Dumuka and Ponak, which had remained uninhabited since the Buddhist inhabitants fled northward across the desert. A similar legend is found in many other places in Turkestan, apparently because similar events occurred. The rain of sand is often spoken of as if it were the cause of the abandonment

of ancient towns. I do not think so, however, because extended observation has convinced me that sand rarely encroaches upon a region until after a decrease in the water supply has caused the death of vegetation. In the Kenan legend it is distinctly stated that the amount of water diminished. The villagers said to me, "You see, what happened to Kenan long ago was like what happened to Dumuka in the days of our fathers. The river dried up."

From Malakalagan I struck a little north of east across the desert to the Keriya River. The first day, our way led through the peculiar scenery characteristic of the parts of the zone of vegetation where the water supply has decreased, whether it be on the edge of the zone near the mountains, or, as is much more common, the remoter border near the sands of Takla-Makan. Steep-sided mounds, twenty or thirty feet high, were scattered over the plain so thickly that we had to wind hither and thither through the narrowest of passages. Rarely could we see more than three hundred feet in any direction, and often only fifty. Through the veil of sand shrouding the sides of the mounds, we perceived that their lower half was composed of stratified river silts full of the gnarled roots and underground stems of ancient tamarisks, while the upper half consisted of fine sand deposited by the wind and kept in place by the upper parts of the tamarisk bushes which projected from the tops. Sometimes the feathery bushes were gray-green and flourishing, with sweet-scented spikes of minute purple flowers, but oftener they were wholly dead, or had already shed the small stiff spines which serve as leaves. At the bottom of the mounds, one was in a maze of sandy slopes, dead tam-

arisk branches, and narrow passages; at the top, one looked out upon what seemed to be a thick growth of bushy vegetation perched upon hills and fading away in the near distance in a dense haze of dust. The scenery was most monotonous and gloomy. No sun broke through the haze; no landmarks appeared; there was nothing to guide us save the compass. Even with that I found it most difficult to make our countless minute zigzags balance one another, and thus to preserve a straight course.

The tamarisk mound is highly significant as an indicator of changes of climate. One finds it in every stage of development, from one foot high with a vigorous growth of slender flourishing bushes, to sixty feet high with nothing but huge, gnarled trunks, dead for hundreds of years. During seven years in Asia, so far as I remember, I have never seen young tamarisk bushes growing anywhere except upon the flood-plains of streams, or in other places where the ground was thoroughly saturated with water. On flood-plains from which the water has been diverted by man for four or five years, half or more of the tamarisks are usually dead or dying. In later stages still more die, and only those with very deep roots persist. Then the wind begins to dissect the dry plain, carrying away the finer materials from the parts where the plants have died, and heaping up the coarser grains of sand in the protected spots where living bushes check its force. Thus mounds are formed, and their height is increased by æolian erosion at the base and by æolian deposition at the top. The depth to which erosion can proceed is limited by the level of underground water, and the amount of deposition is limited by the amount of sand avail-

able from the erosion of surrounding areas. Thus the maximum size of the mounds is determined by the extent to which the water supply has diminished. The actual size, of course, depends partly on the length of time since the water was withdrawn. Judging from the relation of mounds to ruins, I should say that mounds fifty or sixty feet high must be nearly two thousand years old, and those twenty-five feet high from five hundred to a thousand or more. Sometimes tamarisk mounds are formed without a change in the water supply, but such can be easily distinguished from those of which we are speaking. They are characterized by a rounded form, by a vigorous growth of bushes on all sides as well as on the top, and by the fact that they are composed entirely of æolian sand, and not partly of sand and partly of river deposits eroded by the wind. In general, tamarisk mounds are an unequivocal evidence of a diminution of the water supply. When, as in the region we are now traversing, they occur over broad areas where man's activity has had nothing to do with the water supply, they furnish one of the strongest possible proofs of climatic changes.

At the end of our first day from Malakalagan, when we had almost reached the border between the tamarisk mounds and the sandy desert, we came upon the pottery-strewn site of a very ancient town, lying fifteen miles north of Karakir, on the line which the Kara Su River would follow if prolonged. Karakir, to which I made a flying visit on the way to Imamla, is now a little hamlet of about thirty houses, although in the chronicle of the Mohammedan conquest, it is spoken of, under the name of Bowa Zengir, as a village of some importance. A peculiar event took place there

a few years ago. In 1891, some villagers were digging above their spring, as one of them told me, in order to get a little more water. When they returned to their work one morning, they found that the spring had visibly increased, and that the stream from it was perceptibly beginning to deepen its channel. In great delight, they sat down to wait for nature to make them rich, for unlimited land was at their disposal if only they had water for it. A flood from the Kara Su came down not many weeks after, and entering their channel, converted it into a broad, deep trench. In the course of a few months, the new stream grew to a size which proved unfortunate for the villagers. The government heard of it and took possession. The officials, with great profit to themselves, founded a new village, called Karakir Achma, or Karakir Opening. There was a rush like that at the opening of an Indian reservation in the United States. In a few years, the place had a permanent population of two hundred families or more, and was deemed important enough to have a bazaar.

The new channel grew steadily wider and deeper, until in 1905, when I saw it, it had a width of two hundred feet or more, and a maximum depth of about sixty feet, which decreases both upstream and down. For some years the amount of water remained fairly constant, but in 1905 it had been decreasing for two or three years, and the people of Achma had begun to move away. Apparently, the water supply of neighboring villages did not suffer, but rather increased. At Shivul, east of Karakir, new springs broke out, so that between 1885 and 1900, a settlement of twenty families was formed. The Dumuka River also in-

creased in size, and new springs appeared lower down in its bed, as has already been stated. Apparently, in this region, as in all Central Asia, there was an increase in rainfall from about 1893 to 1900, between times of lessened precipitation. The extraordinary abundance of water at Karakir was due probably in part to the increased rainfall, but much more to what may be called an accident. The newly opened watercourse, so it seems, happened to be located in such a position that for ten or twelve years, and perhaps to the time of my visit, the stream continued to deepen its channel. It maintained its volume by continually penetrating to and drawing upon new layers of soil lying well below the level of ground-water, and therefore completely saturated. The temporary increase in rainfall, culminating in 1900, seems to be part of one of the periodic variations of climate which Brückner has shown to take place once in about thirty-six years in all parts of the world. Such changes appear competent to explain the minor changes in the villages and vegetation of the Chira region, for instance the abandonment of Dumuka at the end of a temporary dry period in 1841. They cannot explain the broader facts of the progressive abandonment of cultivated areas and the death of vegetation from north to south. If the climate of to-day is like that of the time when the old town north of Karakir flourished, there is no reason why the vegetation around the ruins should have been dead for centuries. To-day, if all the water of Karakir were free to flow as far as it could, it would not reach the ruins.

On leaving the ruins, we spent a day and a half in traversing an almost absolutely barren area of reddish or yellowish

sand dunes, from ten to a hundred or more feet high. There had been a high wind two days before, and the air was still so full of dust that we could scarcely see half a mile. In the dense haze the larger dunes loomed like distant mountains, and again and again we were amazed to find ourselves suddenly at the foot of a small hill, which we had felt must be a mountain miles away. As we zigzagged hither and thither in climbing the steep western fronts of the larger dunes, or as we walked along the narrow crests and looked down the apparently precipitous slopes into the remote, hazy hollows, we experienced the sensations of genuine mountain-climbing. There was a sense of height and space; we involuntarily drew back at the sound of an avalanche, though it was only sand slipping from under our feet; we gained each crest with the joy of achievement; and we walked warily, to avoid a fall that would plunge us down a thousand feet, as it seemed.

In the midst of this weird illusion, we unexpectedly arrived at the top of a bluff. Below us lay the fair savannah of the band of vegetation along the Keriya River, a narrow plain dotted with clumps of tamarisk bushes, or groves of poplars rising from a gold-flecked, silver-plumed undergrowth of green reeds. We traveled down the left bank of the meandering river, sometimes in the open plain of reeds, sometimes among the poplars, and occasionally out into the tedious sand of the desert, when the stream swung far to our side. Now and then we passed a shepherd's hut of tamarisk branches, or, more rarely, a flat-roofed cabin of poplar poles, reeds, and mud.

Sixty miles below Keriya, we left the river, which contin-

ues onward to the north, and directed our course westward toward Dandan-Uilik across ridge after ridge of sand, fifty to one hundred feet high. All the ridges, in response to the prevailing northeast winds, faced in general southwest. Their gently sloping backs to windward were gray with a cover of rather coarse sand, while their steep fronts to leeward were pale brick-red with the fine sand of the main desert. The backs of the larger dunes were diversified with smaller dunes, like shoals of mounting fish, and the small ones in turn were covered with ripples. All the forms, whether of dunes or ripples, were on one pattern, endlessly varied. The variety and grace of the curves in the sand, like those of drifted snow, give the sandy desert an unceasing interest and beauty. It is utterly unlike the monotonous flat deserts of gravel, clay, and salt, though even those have beauty of a certain sort. The charm increases as the dunes increase in size. The sand is truly awful in times of heat and wind, but when, as during those days at the end of September, the hours of sunshine are pleasantly warm, the nights are fresh, the air is still, the way is known, and a water supply is assured, its unique beauty is indescribable. The sandy desert is at its best in the morning, when, as often happens, the haze falls to the earth during the quiet night, and the shadows of a clear sunrise bring out all the details of form.

My plan had been to go direct from the Keriya River to Rawak, the northern part of the ancient oasis of Litsa, and then south to Dandan-Uilik. In order to follow as straight a course as possible, I directed our way with the compass, heading for a point between Dandan-Uilik and Rawak.

It was easy to keep the direction, but extremely difficult to estimate the distance traversed because of the continual zigzagging necessitated by the sand dunes. This was immaterial, I thought, because Ibrahim Beg would recognize our destination as soon as we came near it. On the afternoon of the second day from the river, we came upon fragments of pottery and traces of old canals. We were only twenty-two miles from the river, according to my estimate, though the distance to the ruins was twenty-six, according to Stein's excellent map. However, we were certainly near the ruins; so I told Ibrahim Beg that it was his turn to play guide. To my amazement, he said that he had never been to the Rawak portion of the ruins at all, and to the Dandan-Uilik portion only a single night. Then he arrived after dark and left before daylight. When the people at Chira all agreed that he was an authority on ruins, he had been ashamed, apparently, to confess his ignorance. Moreover, he wanted the good present which Sahibs are known to give. Accordingly he came along, trusting vainly that he might find a shepherd to guide us. His action was characteristic of the weak cupidity of the Chantos.

We spent the next twenty-four hours in hunting anxiously for the ruins. The five of us deployed widely in order to cover as much ground as possible. First we searched vainly to the northwest and north in the hope of finding Rawak; and later, to the south. There finally we found Dandan-Uilik, only a mile and a half from where we had first come upon pottery. We had no idea as to the location of Stein's wells, or as to the depth at which we might find water if we dug a new one. I dared not waste time in an

attempt which might prove futile, for the camels had already spent three rather warm days without water, and a two days' journey lay between us and the river. I went on that night some six miles to the south, in the direction whence the ancient water supply must have come. Before sunrise the next day we were under way, making straight for the river. The camels' throats were so dry that they began to rattle distressingly. The creatures knew that they were headed for water, and traveled more than half as fast again as on the outward journey. We reached the Keriya River that night, doing two days' journey in one, in spite of the soft sand and the countless zigzags. We men did not suffer as the camels did, but another day would have exhausted our melons and water, and then we too, like the camels, should have felt the pinch of thirst. It was fortunate that we had not depended on Ibrahim Beg's estimate of how much water we should need. If we had, we might have joined the company of improvident Chanto treasure-seekers, who, as one hears in every village, have perished of thirst while hunting for the gold supposed to lie buried among the ruins beneath the sands of Takla-Makan.

In spite of difficulties, the trip to Dandan-Uilik was a success. The canals and pottery between the main ruins and Rawak were seen to indicate that an area seven or more miles wide from east to west must have been under cultivation. The length of the cultivated area, including Rawak on the north and a group of houses which I discovered two miles to the south of Dandan-Uilik, must have been at least nine miles. In other words, the oasis of Litsa, in its prime, had an area of nearly fifty square miles. Be-

fore Rawak was abandoned, about 300 A. D., the cultivated area was but little, if any, smaller than that of modern Chira, which is estimated to have a population of ten thousand souls. Moreover, the ruins lie in the midst of a great expanse of dead vegetation, extending a dozen miles to the east, and an unknown distance in other directions. I traversed beds of dead reeds and poplars for six miles south of Dandan-Uilik, and could see dead trees extending indefinitely to the north and west. The reeds were broken off close to the ground, and were largely covered with sand. One scarcely noticed them; the poplars, on the other hand, stood up boldly. Near the ruins, dead tamarisks were numerous. A few stood on mounds; but the majority were on the level plain, just as they grow to-day near rivers or in the moister parts of the zone of vegetation, especially in the region immediately around the modern oases. I found no indication that the Keriya River ever flowed to Dandan-Uilik. Nevertheless, in ancient times the place received a supply of water large enough not only to irrigate the oasis, but to support abundant vegetation over the plain on every side. Apparently, in those days Dandan-Uilik stood among surroundings practically identical with those prevailing to-day around the villages of the zone of vegetation.

It has often been assumed by writers on the Lop basin and on deserts in general, that the encroachment of sand is the chief cause of the death of vegetation and of the abandonment of oases. Their theory holds that deserts by their very nature devour the regions around them. Doubtless this occasionally happens, but in the Lop basin, at least, it is the exception, not the rule. Usually the vegetation dies

first, and then the sand of the desert begins to encroach. Throughout an area of many square miles around Dandan-Uilik, half, more or less, of the dead vegetation is not covered by sand at all, or at most only by dunes from two to five feet high. Such dunes, accumulating slowly as they must, could not possibly kill vigorous tamarisks, and much less large poplars. On the borders of the zone of vegetation, where ground-water is comparatively near the surface, I saw literally scores of places where the advance of sand had been checked by plants, and dunes had accumulated to a height of fifteen feet or more. In such cases, the vegetation was interfered with somewhat, but the stronger plants, including even the reeds, had responded to the exigency, and had lengthened their stems so as to keep above the drifts. Where the sand had passed by, new vegetation had sprung up in the hollows to replace the weak plants which had been killed. If, as at Dandan-Uilik, the vegetation of a region is all dead, and especially if it has died where there is not sand enough to injure it greatly, it is safe to say that the encroachment of sand has nothing to do with the matter. It is an effect rather than a cause. The true explanation of the dead vegetation and of the peculiar location of the ruins of Dandan-Uilik and Rawak seems to be that the water supply has been diminished by a change of climate.

After our trying experience in the desert, we rested a day, October 1, under the poplars beside the Keriya River. The air was of so perfect a temperature that one did not feel too cool in the shade or too warm in the sun. From our camp we looked out between two massive poplars at

the gleaming expanse of the broad, shallow river, with its sand-bars, snags, and driftwood. Beyond it lay a golden plain of reeds, and a low belt of green poplar woods. The scene might almost have been on some slow river in Indiana. But the white and brown flock of fat-tailed sheep, the shepherd boy wading across the stream in a white gown and a fur cap, and above all the great two-humped camels stripping the leaves from the poplars, disturbed the illusion. The line of low yellow hills a mile away beyond the band of green was the border of the great red desert, whose slowly drifting sands have marched persistently forward for two thousand years or more in the wake of dying vegetation.

In returning to the region of villages, I followed a route in the sand several miles west of the Keriya River. There was nothing which could by any possibility be an old course of the river leading to Dandan-Uilik. There were, however, a number of isolated areas of dead vegetation lying in large hollows surrounded by sand. They became more numerous as we approached the zone of vegetation. Along the border of the zone, half or more of the plants were dead. Such phenomena furnish strong evidence that not only among the ruins, but in other parts of the now lifeless desert, vegetation flourished abundantly at no very remote period.

CHAPTER IX

KERIYA AND NIYA

KERIYA, the Pein of Marco Polo and Pimo of Hwen Tsiang,[1] is a pleasant district, with a population of about fifteen thousand souls. I was much disappointed on reaching there to find that my men had not been able to buy any camels or make any other preparations. The natives were full of promises and pleasant words, but that was all. The camel-owners, so it appeared, had formed an "agreement in restraint of trade," and would offer nothing but the poorest animals at the highest prices. I sent for the chief Beg and asked his assistance, which he promised most readily, but the next day nothing had been done. I sent for him again.

"Did you promise to see that some camels were brought here to-day, and that the merchants who promised goods to us brought them at once?" I asked.

"Yes," he answered, "but every one was busy this morning."

"Did you make those same promises to my men two weeks ago, ten days ago, five days ago, and three days ago?"

"Yes, but there was much to do. We are busy. Do not be angry. I will do all that you wish to-morrow."

"Very well; do you promise to do it all to-morrow?"

"Yes, I promise."

"All right. A man who does not keep his promises is a

[1] See Appendix.

liar, is n't he? If you don't get things under way to-morrow, I will tell the Amban that you are a liar, and then you will lose your office. You saw how he bowed his head to my passport [because it was from the Emperor], and you know that he will do what I tell him."

The Beg went away frightened, and that very afternoon the merchants suddenly found that they had leisure to attend to our wants. A large number of camels were brought for our inspection, from among which we selected two that were suitable. We would not bargain for the animals. We only said to the owners: "You and the other camel-merchants decide what they are really worth, and we will pay it; but any man who tells us a lie hereafter will get into trouble." When the camel-trust met to talk the matter over, affairs took an unexpected turn. An old man called Yusup Beg got up, so we were told, and made a long speech.

"Are n't you ashamed of yourselves?" was the substance of what he said. "You, Tokhta, have a hundred animals; you, Hashim, fifty; and you, Dursun, two hundred. Can you not sell one apiece for the good name of our city? Shame on you! We are disgraced! If I had been here, you should not have acted so. The stranger has come from afar. He shall see that we are not all dogs and pigs. I have thirty camels. He shall choose the five that he wishes, and name his own price."

Yusup Beg was as good as his word. He let us choose three splendid animals, and seemed perfectly satisfied when we paid a price which was decided upon by the United Camel-owners, and which every one said was fair. We paid the tax which properly should be paid by the seller, but

even so, the animals were a most fortunate investment; for they did us the best of service, and we sold them at a profit far away at Turfan, where prices are much higher.

During our stay at Keriya, I learned of another reason for believing that the Keriya River never watered the oasis of Litsa. Except at times of high flood, all the water of the Keriya River is spread out on the oasis and disappears. Below the city, however, numerous springs well out and give rise to a new stream, which meanders northward through the desert for over a hundred and fifty miles. In traveling down the river on the way to Dandan-Uilik, I marveled that so large a stream, flowing perennially through a low, smooth plain, was not utilized for irrigation. When I questioned the shepherds, they merely said that there were no people. At Keriya, two or three well-informed men told me that attempts had been made to use the water, but all had failed. The first year the crops were good, but the second they dwindled greatly, and were not worth raising. The trouble lay in the salinity of the river. Evidently, such a river could never have watered the oasis of Litsa with its large villages of Dandan-Uilik and Rawak.

To-day, the Keriya River ends in the sand halfway from the town of Keriya to the Tarim River. Beyond its present terminus the sand of the Takla-Makan desert prevails, and no caravan except that of a daring explorer like Hedin can possibly traverse the waterless desert. Nevertheless, Littledale was told by a Chinese official that formerly there was a road down the river and across the desert to Kucha; and Stein says that "a remark of Mirza Haidar, the Moghul leader and historian, makes it very probable that the

Keriya River reached the Tarim as late as the sixteenth century." About 1000 A. D., according to the legend which I heard at both Malakalagan and Keriya, the ancient Buddhists, fleeing from the Mohammedan invaders, went down the river and so to the north, which would be quite impossible to-day. At a still earlier time, there seems to have been an important road along this route, as appears from the small ruins of Kara-dong discovered by Hedin forty miles above the present flood limit. Stein, who later explored them, assigns their abandonment to the third or fourth century of our era, the time when Rawak was abandoned. He thinks that Kara-dong was "a fortified frontier post or roadside 'Sarai'" guarding the road from Keriya to Kucha. Such a road could have existed only if the Keriya River once flowed farther than it does now. That it did so flow is proved conclusively by the dead river jungle which Hedin found for twenty or twenty-five miles beyond the present terminus of floods. The greater length of the river does not appear to have been due to less extensive use of the water for irrigation, for from the earliest times, Pimo, or Pein, seems to have been at least as large and prosperous as modern Keriya.

The obvious inference is that here again we have evidence of a change of climate.

On October 11, 1905, after four days in Keriya, I started eastward once more, without having stopped a day longer than I wished. My caravan, as then constituted, consisted of five splendid camels, eight horses, and five men, not including guides. The numbers sound large to one in the habit of traveling in less remote lands. As a matter of fact, they

are unusually small for Chinese Turkestan. I spent the next five weeks in exploring the lower ends of the Niya, Yartungaz, and Endereh rivers. All three furnished seemingly conclusive evidence of a secular change of climate. The whole country for six or seven hundred miles east of Keriya is so scantily populated that the human factor can in many cases be eliminated, and we are able to form an exact estimate of the influence of purely physical causes on the size and salinity of rivers and on the distribution of life.

From Keriya I sent the camels directly to Niya, while I went with the horses by way of the gold-mining town of Sorgak. The town lies on the enormous fan delta of gravel which the Niya River has deposited where it suddenly emerges from the Kwen Lun mountains and crosses the old fault-line to the relatively level basin floor. Sorgak presents the essential features of a mining town in the southwestern part of the United States. Perhaps it is a trifle more barren and unattractive than the worst of our mining towns, but from a distance it gives the same impression of rawness to the traveler. It lies in a basin-shaped valley a quarter of a mile or more from the edge of the deep gorge of the Niya River, whence water must be brought up on the shoulders of women, or the backs of donkeys. Not a vestige of verdure can be seen, nothing but gravel with dugouts half buried in it. Here and there a blatantly new shanty with a mud roof and an unseasoned wooden front stands among the older, duskier structures. The population of the region is said to be between three and four hundred families, and the total number of men who work as miners,

including those who stay only a month or two, is about two thousand a year. The annual output of gold is only twenty-six thousand dollars, or thirteen dollars per man. Thirteen dollars a year does not seem to be a sum calculated to encourage lavish expenditure. Nevertheless, the uncertainties of the miner's life and the possibilities of sudden wealth lead to the same extravagance in Central Asia as in western America. The bazaar is surprisingly large and busy considering the size of the population, and it is filled with idlers. As I walked about to take photographs, I counted a hundred and twenty men and boys following close behind me, and there were certainly fifty more sitting idle in places which we passed. I did not count the baby which lay bound in its cradle in front of a closed shop.

As we rode into Sorgak, I was surprised to see our honest friend, Yusup Beg of Keriya, coming out to meet us. It appeared that he was Beg of Sorgak, and had come a three days' journey from home simply to see that I was comfortable. When I wished to give him a present, he told Ibrahim that his sole desire was that I should write his name in my "deftar," or note-book, and give him a letter to put in his box. We were told that he was very unwilling to become Beg of Sorgak. What did he want of such a place? He was old, and had held much higher positions. The Chinese amban of Keriya, however, though a most corrupt man himself, insisted upon having an honest man in charge of the gold-fields. The natives, as well as the Chinese, appreciated his honesty. When it became known that he had been appointed Beg of Sorgak, seventy families from Kapa, a gold-mining town a hundred and fifty miles to the east,

promptly moved to Sorgak, in order to be under the rule of a man who did not "eat" money.

Many of the mines at Sorgak are located on the top of the great gravel fan, far from the gorge of the river. Accordingly, the miners winnow the gravel instead of panning it. When first I saw this primitive process, the gravel was dumped in a conical heap two feet high. With their bare hands, scarred and maimed by frequent cuts, bruises, and sores, a man and a woman moved the heap forward by throwing handful after handful to the top. The finer sand was blown away during the process, and the coarser fragments rolled to the bottom of the cone, where they could be brushed away. Thus the advancing heap was gradually diminished in size, and reduced to a somewhat homogeneous mass of very fine pebbles and coarse sand. At length the miner put this in a wooden pan, and holding it higher than his head, poured it into a cloth on the ground, thus allowing the wind to blow away part of the remaining sand and pebbles. In the midst of the pouring, the young man stopped and began to whistle. "What are you whistling for?" I asked. "For the wind," was the sincere answer.

When the wind had done its work, the miner spread the remaining gritty mass thinly over the cloth, and blew it away by mighty blasts from his lungs, beginning on the edges and working inward. All his partners, of both sexes and all ages, or at least as many of them as could find room, gathered around the cloth, and, lying on their stomachs, watched with the traditional gold-miner's excitement for traces of the yellow metal. A little girl pounced on a flake, but that was all.

"Only ten cents' worth of gold for the morning's work of ten of us," was the discouraged remark of the strong-lunged miner; and his "ten of us" meant only the men who share the mine, not the women and children who had helped.

Niya proved to be a pleasant town of about four thousand inhabitants. On the 17th of October, we found the shady lanes bordered by rows of thrifty poplars, still almost as green as in summer. The fields had apparently borne heavy crops, though all were now bare with the exception of the rustling corn-fields, whose half-gathered golden crop made spots of color on the flat roofs of the warm mud houses. The people were much like those of other places. They looked well-to-do and comfortable, though they mildly complained that the Chinese amban of Keriya had lately increased their taxes, and that their late Beg had oppressed them. After the polite and hospitable fashion of the Chantos, the new Beg invited me to go hawking. Accompanied by a merry party of friends, and by two retainers carrying hooded falcons on their gloved wrists, we rode down the river. Broad reaches of sluggish water invited wild duck to halt, and an open plain of low, grassy reeds dotted with feathery tamarisk bushes afforded shelter to numerous hares. The sport was poor, but the good humor and jokes of the hunters, and our exciting races after the falcons, put every one in high spirits. I realized what good fellows the Chantos can be, and how much they resemble ourselves in spite of certain weaknesses.

The Niya River is much like the Keriya. It is not strange that travelers have been deceived as to the possibilities

of this region. For instance, Stein, a most careful investigator, remarks: "The thought that all this fertile stretch of ground might well be brought under cultivation had occupied me as I rode along. It was therefore a pleasant sight to me when a little below Nagara-khana [nineteen miles north of Niya] . . . I came upon the head of a canal begun only two years previously under the amban's orders. . . . Close to the route runs the new canal, a modest work so far, only six to eight feet broad, yet likely to bring life and wealth to this lonely woodland. The soil is a fertile loess, and the level of the ground is so uniform that its irrigation will be easy when the jungle is once cleared away. For over eight miles we followed the canal, and I pictured to my mind the changes it is likely to bring soon to this silent scene."

When I saw the canal, five years after Stein's visit, it had already been abandoned for two or three years. The water was so saline that, after the first year or two, agriculture was impossible.

The first inhabitants whom we found on the lower Niya River were at the shrine of Imam Jafir Sadik, the most famous shrine in all Central Asia, where the Niya River reappears for the last time. There we stopped for two days while the men offered sacrifices. The shrine was founded, or perhaps revived, during the wave of migration which spread eastward from the large western oases between 1830 and 1840. In response to the reputed dream of a holy "mulla," a reforming ruler endowed it with all the land of the then practically uninhabited Niya valley. He appointed a chief sheikh and four others, one of whom was the grandfather of my informant, one of the present sheikhs. The town of

Niya, founded at that time, grew until now it numbers over four thousand inhabitants, and the shrine, to which all the land still belongs, has grown very rich. A year before my visit, the Beg of Niya, who was soon removed from office, cast longing eyes upon such an opportunity for plunder. He created five new sheikhs, who in a year "ate up" the property so fast that the number of sheep was reduced from five thousand to three thousand. A man with three hundred sheep, it should be remembered, is considered rich.

The beggars of Imam Jafir are an important feature. A sheep is killed daily for them except during the late spring and early summer, when, as one of the sheikhs said: —

"The pot is no longer boiled. The beggars do not need it. They wander out into the villages, and for three months fill their stomachs with mulberries and apricots."

The shrine is regarded with such veneration that the pilgrims dismount for the first prayer half a mile away. At this point, where they first catch sight of the shrine, a rude gateway has been erected, two upright poles with waving horse-tails, crossed by a third. Farther away from the holy place exultant pilgrims have set up dozens of still simpler gateways, tree-trunks placed across the road from one living poplar to another. Perhaps the gates reflect the feeling that whatever is great must be inaccessible. As a man at Keriya put it, when speaking of a petition to the Chinese governor: —

"But how do I know that he received it? He is a great man. He is behind many doors." And each door, it may be added, is opened by a man with an empty palm.

At Niya, when I explained to the native officials that I

was searching for ruins buried in the sand, they sent post-haste to Keriya for old Adulla, a professional treasure-seeker. After a rapid ride of a hundred and ten miles, he overtook me a few miles north of the shrine of Imam Jafir Sadik, at the point where the Niya River finally disappears. During the next few days, he led me through five or six miles of ruins which no European had ever seen before.

"How is this?" I said. "You say you were the guide of the Sahib who came to this region five years ago. Why did n't you show him all these ruins?"

"Oh," was the nonchalant answer, "the Sahib's camel-man, cook, and hostler frightened me. They were afraid to go out into the sand, and they wanted to go home. They said, 'Don't tell the Sahib anything. He knows of the "stupa" [shrine], and we can't help his finding that, but he does not know of the other places. Lead him around them.' So when the Sahib said, 'Adulla, do you know of any other ruins?' I said, 'No, Sahib, even if you cut my throat for it, I should still say there were no more ruins. I swear by Allah that I never saw or heard of any.' And then when the Sahib went himself to hunt, I and the others led him away from the ruins."

The sanctimonious old man did not seem in the least ashamed of his lies. Indeed, he was proud of them. Perhaps he cheated me too. Still, I think he showed me all he knew, for Ibrahim, who was almost as keen in the search as I, pumped him night and day.

The shrine of Imam Jafir Sadik is located, as I have said, where the Niya River "reappears for the last time." The phrase expresses an important fact. The river disappears

first in the zone of piedmont gravel. At the edge of the zone of vegetation it reappears, and after watering Niya, sinks into the ground a second time. Within a few miles it comes to light again, only to be lost in the course of the next twenty or thirty miles. Finally, at the shrine of Imam Jafir Sadik, fifty miles from Niya, it reappears once more, but with such diminished volume that it persists only five or six miles before disappearing for the fourth and last time. During the flood season, an uninterrupted stream flows from the mountains to the last shepherd hut below the shrine, but it is very temporary, and does not persist more than two or three miles beyond the limit of the winter stream.

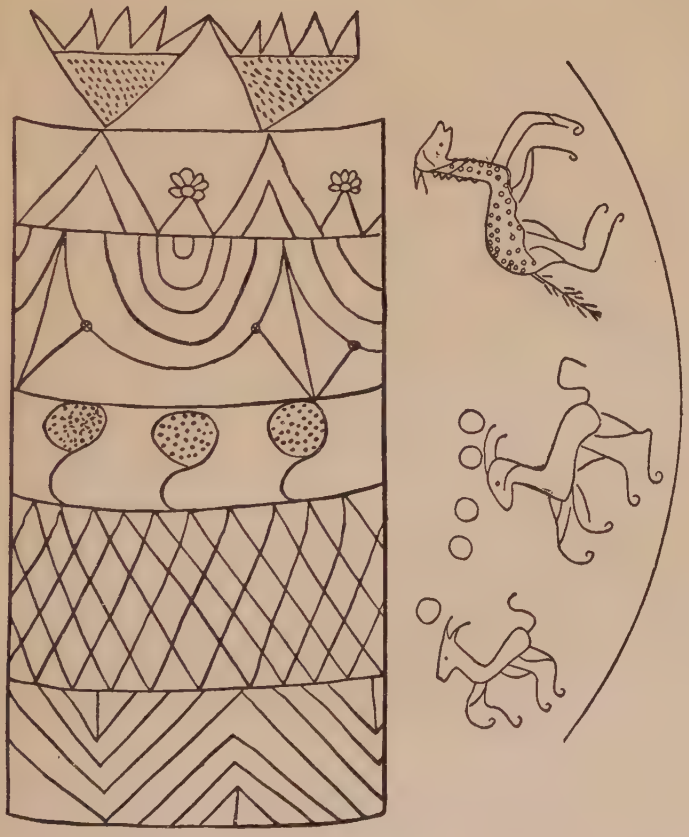
In an arid region like the Lop basin, water which flows far underground becomes saline. Even Niya suffers from salinity. North of the town I crossed fully half a mile of land formerly reckoned as "first" of the three classes rated for taxation, but now abandoned as too saline for anything save pasture. Year by year fields are being given up at a rate which threatens the extinction of the oasis within a few generations. As might be expected, the water is even more saline farther downstream, and permanent cultivation is impossible. Various attempts, in addition to the one mentioned above, have been made to found villages near the shrine and farther upstream, but all have failed within three or four years at most. At Imam Jafir Sadik, eleven families, scattered along the river for four or five miles, raise a little corn, wheat, alfalfa, and melons, but cannot cultivate trees. They choose the sandiest, least saline soil, and by cultivating a given patch only once in two or three years, manage to eke out the produce of their flocks. In one

exceptionally favorable location, I was told that cultivation had been carried on irregularly for twelve years, but in most for only two or three. It would to-day be impossible to establish a permanent agricultural village below Niya, just as below Keriya.

In ancient times conditions were very different. Fifty-seven miles due north of Niya, and seven miles from the shrine, at the point where the largest floods disappear in the sand and the most northern living poplars are found, we came upon the southern houses of an ancient town. Stein believes it to have been abandoned about 300 A. D. The remnants of the town consist of sites strewn with pottery, the remains of orchards full of fruit trees and the white poplar, a "stupa" or Buddhist shrine of sun-dried brick, and the beams and lower walls of ancient houses, of which I counted a hundred and sixteen. The town was large and prosperous. It was inhabited for a long time, as appears from the nature of the ruins and the size of the trees. Its date is known from coins, and from many documents in the Kharosthi tongue. These are written upon wood, and are found in the various forms shown in the accompanying illustration. Accounts, official orders, memoranda, and letters were written upon strips of wood of various carefully defined shapes. Data to be kept for future reference were recorded on strips like A, E, and G, which were filed away in rows, or were hung upon strings run through the holes at the pointed ends. The most interesting specimens which I found are C and D, parts of two letters. The communication was written upon the concave side of a strip such as C; and upon the convex side of a complementary strip of exactly the same size. The two were then

placed face to face, so that the writing of both was concealed. Next, the address was written upon the outside of the concave sheet of the unique letter. Finally, a string was run through a hole in the concave sheet, and brought around through slots to a square depression such as that of D in the convex sheet. There it was sealed with clay, and stamped with a seal like those of the illustrations on the cover of this volume, and was ready for the postman.

According to Stein, the area covered by the ruins of the Niya River site, as he calls it, is eleven miles north and south, and four and a half east and west. I found two houses over two miles south of any seen by Stein, and a large group surrounded by a broad area of pottery about three miles north. This makes the length of the oasis at least sixteen miles. The extreme dimensions of modern Niya are given on Stein's map as eight miles by three. That is, the modern oasis is only a third, or at most half, as large as its Buddhist predecessor of the early part of the Christian era. In more ancient times the cultivated area may have been still larger. Far out in the sand, six miles beyond the most remote ruins, I found some bits of slag from furnaces, and the two mealing-stones held by the camel-man at page 254. The guide, old Abdullah, had brought us to see some sort of brick fireplace which he had discovered when he visited the place a year before on a treasure hunt. He described the location with great precision, and led us to a spot where we found traces of his camp, but he could not find the fireplace. We searched in all directions for two hours; and while he was away, out of sight, I found the stones and the slag, which convinced me that the man had not been lying. He searched



Ancient designs rudely scratched in coarse red pottery. The animals are from the Niya River ruins, the conventional design from Endereh. Reduced.

longer than the camel-man and I, and finally had to be recalled. He did not know what I had found, and supposed that our quest had been in vain. As he had already told Ibrahim what a liar he was, he supposed that I would think that he had been lying again. He came back in a sad fright, apparently expecting an immediate beating. I gave him a little coin instead. A look of amazement and incredulity went over his face, and then, as he realized that I meant it, he fell on his knees, stroked his beard with a long invocation to Allah, and wanted to kiss my feet.

The stones and slag which we found apparently belong to a time more ancient than the ruined houses. Possibly they are of the same date as the thickly strewn pottery of an area over two miles long lying around the most remote houses, but the appearance of the tamarisk mounds in the vicinity indicates that they are older than the houses themselves. The pottery, with the accompanying slag and bones, is in a much finer state of comminution than is common among the main ruins. It is possible that it represents a town more ancient than the Niya of the Kharosthi documents, or at least the part of a single town which was abandoned at a very early date, just as Rawak was abandoned before Dandan-Uilik.

The condition of the vegetation agrees closely with that of the ruins. To the end of the present flood channel it is vigorous; a little farther out in the desert among the upper ruins, the great majority of the poplars are dead, but retain their branches, and the half-dead tamarisks form mounds ten or twenty feet high; among the main ruins the poplars have been reduced to mere trunks with few or no branches,

and the tamarisks are largely dead, although a few still survive on mounds thirty feet high; and finally, from the area of finely comminuted pottery to and beyond the mealing-stones the poplars are mere stumps five or six feet high, or have been broken off by the wind even with the ground, and the tamarisks have practically all perished, after in some cases forming mounds fifty or sixty feet high.

The desiccation of the Niya ruins, like that of the Chira group, cannot be explained by the encroachment of sand, the diversion of tributaries, or the lowering of the level of ground-water by erosion. There is not the slightest evidence that the ancient irrigation system was better than, or different from, that of to-day. Here, just as at Dandan-Uilik, it would be the height of folly to carry water seventy miles into the desert, when it might be employed to vastly greater advantage where it is now used at modern Niya. The growth of the present town cannot possibly have caused the abandonment of the ancient site; for it has grown up within a century, while the old town was abandoned sixteen centuries ago. Furthermore, as modern Niya is barely half as large as the old Buddhist oasis, and as it uses all the water available, its water supply would manifestly be scarcely half enough for a town such as that of antiquity. Indeed, even if modern Niya were non-existent, a river of the present size could not so much as reach, much less irrigate, the main ruins. At least, it did not reach them when it was free to do so if it could. Up to about 1840, the population of Niya amounted to only a dozen or fifteen families at most, and the consumption of water was negligible. The river ran freely as far as it would; but even so, it did not

reach the ruins. It must have been accompanied by vegetation to the end of its course, just as it is to-day. The ruins, for the most part, however, lie among vegetation which has been dead so long that the majority of the trees have lost their branches, and must have perished centuries ago. A comparison of the Niya River site with old Dumuka illustrates the matter. An abundant water supply was cut off from Dumuka in 1841 at a single blow. The vegetation is still vigorous, and only the weaker plants have died. If an equally abundant supply was cut off from the Niya ruins at approximately the same time, it is hard to see why the vegetation in the one case should be vigorous, and in the other should appear to have been dead hundreds of years. Altogether, it is highly improbable that the river would reach the ruins even if there were no such place as modern Niya. The idea of its not only reaching them, but supporting twice as large an oasis as it now does sixty or seventy miles upstream, is still more untenable. Apparently, at the beginning of the Christian era, the available water supply of the Niya River — which may be a very different matter from the rainfall of the region — was at least three times as great as now. One part or more was needed to balance the absorption and evaporation of the sixty or seventy miles from Niya to the ruins, and two or more to irrigate the ancient oasis. It is highly probable that the site of modern Niya was inhabited at that time, as it certainly was three or four centuries later, in 644 A. D., at the time of Hwen Tsiang's visit. In that case, the water supply must have been four or more times as great as now.

If we suppose that the climate of Central Asia has grown

more arid during the period covered by history, all the difficulties disappear. Under less arid conditions, the Niya River would not only be larger, but one or two small streams, which now wither to nothing in the desert to the east, would join it below the modern oasis. The water would be much more free from salt, for a relatively small portion would flow underground. As aridity increased, outlying settlements would be abandoned in the order of their remoteness, and the vegetation around them would gradually die. When the remoter oases had been deserted, it may have happened that the Niyang of Hwen Tsiang persisted for many centuries on the site of modern Niya. Finally, before the time of Marco Polo, 1295 A. D., it, too, must have decayed and vanished, perhaps because of slowly increasing salinity which gradually ruined the fields, as it is now doing once more after their recovery during a long period of rest. It is, perhaps, not insignificant that in one of the wooden documents found by Stein in the main ruins, "we read that all the 'Shodhagas' and 'Drangadaras,' evidently local officials of the district, are complaining of the want of water."

CHAPTER X

THE LAND OF WITHERING RIVERS

AFTER visiting the Chira ruins, I had come to the conclusion that on the Yartungaz River, east of Niya, there must be ruins like those found on other rivers. Accordingly, at Niya I had told Ibrahim and the local Beg to find a man who could guide us to them. After much inquiry, the two men were told that a certain old man, named Abdur Rehim, knew the place. They brought him to me in triumph, but he asserted that, though he had hunted for ruins at the lower end of the river in the sand, he never had found any. Ibrahim and the Beg of Niya, nevertheless, insisted on his telling the truth and concealing nothing. Finally, he confessed that nine long days out in the waterless sand, he had found an ancient site marked by a little pottery, but without the slightest trace of houses. We laughed his nine days down to three, and were so pleased with ourselves that he dared not change his statement further. So now, ten days later, when we returned to the shrine of Imam Jafir, he joined us according to agreement. His spirits were extremely depressed. None of Ibrahim's promises of meat and rice as good as those of the Sahib himself, not to mention tea and sugar, and a camel to ride when he was weary, had any cheering effect. The fact was, as we became absolutely convinced the next day, that he had been telling the truth at first and lying later. Out of fear of the Beg's displeasure, he had made up his tale of ruins, hoping that their

remoteness and small size would prevent us from seeking them. Failing that, and not daring to confess the truth, the stupid, timid man was going to lead us on a wild-goose chase, and when he got us far enough into the sands, pretend that he had lost the way. Later, we found a man who really knew of the ruins, which are located fifty or sixty miles farther upstream than I had supposed. I could not go back to them myself, but sent Ibrahim, who was exceedingly proud of the neat little sketch map which he drew, and of the pieces of pottery which he brought back.

After traveling eastward for two days under Abdur Rehim's guidance, through a region of great dunes a hundred and fifty feet high, we reached the Yartungaz River on October 28th. The fall colors of the jungle were still glorious. The poplars, wherever their leaves had not fallen, were pure yellow, often of a lemon tint; the reeds, golden a few weeks before, had now become brown, with occasional yellow leaves. Their feathery tufts of seeds, which filled the air with downy parachutes, presented a wonderful intershading of the most delicate tints of gray and silver. And the tamarisks, most marvelous of all, showed an array of colors as varied, though not so bright, as those of a New England forest. Deep purple shaded through brown into bright red; or, more rarely, dusty gray passed imperceptibly into orange and yellow. Over all there lay a soft reddish shade, rare in this sunny land, where most of the vegetation brightens from green to yellow, and then fades to brown.

At Yartungaz, the whole population of about fifty gentle souls was at our service. The clearing, where six families

carry on a little cultivation, looked fertile: there were miles upon miles of smooth plain; and a large amount of water lost itself in the sand a mile or two beyond the farms; but I no longer wondered at the apparent waste of opportunity. The water of the river, though drinkable, had a sweetish, insipid taste. It is so highly charged with salts — borax and potash, I should judge, as well as common salt and soda — that it supports no permanent human settlement, even where it first enters the zone of vegetation. The only inhabitants are the few shepherds whom we saw. They have been here since about 1860. During recent years, part of them have carried on a little agriculture, either sowing a given field once in three years or more, or cultivating it two or three years till it is ruined and then abandoning it. Permanent cultivation, however, is impossible. The Yartungaz River, even more than the other rivers which I explored, shows evidence of a change of climate. In the first place, the marked contrast between Haiyabeg, the large agricultural village of ancient times of which Ibrahim found the ruins, and the pastoral hamlet of to-day, where the permanent practice of agriculture is impossible, shows that the river has grown more saline. Secondly, the old channels of the river, including that of Haiyabeg, are all from five to twenty miles longer than the present stream, and on every side there are large areas of vegetation which has been dead for centuries. And finally, in spite of the fact that during the last five years the villagers have dammed the distributaries of the river so as to keep all the water in the main stream, and thus make it as long as possible, old beds of dead reeds, the form of vegetation responding most quickly

to changes in the water supply, extend beyond the present flood limit for over twenty miles. Dead tamarisks and poplars extend nearly as far. It is evident that the size of the river has decreased greatly.

Two days' journey east of Yartungaz, we came to the hamlet of Endereh, on the Endereh River. In exploring the surrounding country, I found that here, too, we have most convincing evidence of a change of climate. To-day, the entire population supported by the river amounts to about eighty. A little land is cultivated with much difficulty because of the salt, but the main business is the herding of sheep. To live by agriculture would be impossible. Yet in ancient Buddhist times, a dense population dwelt along the eastern side of the river for a distance of at least fifteen miles north and south, and an indefinite distance east and west. Pottery, bones, and stones brought by man abound, as I discovered, in the northern part of this area; while forts, houses, temples, and gardens are scattered over an area of many square miles to the south. As the ruins are situated two hundred and fifty miles east of Khotan, there can be scarcely any doubt that they are identical with the Tuholo of Hwen Tsiang, and the Mo and Han-mo of his predecessor, Sung-yun. These places are located nine hundred li, that is, from two hundred and forty to two hundred and sixty miles, east of Khotan. Sung-yun, in 518 A. D., speaks of the city of Mo, six miles west of which lies the city of Han-mo. Three or four miles south of the latter, there was in his day a large temple with about three hundred priests, worshipers of a golden figure of Buddha eighteen feet high. Hwen Tsiang, in 644 A. D., says that "the old kingdom of

Tu-ho-lo" (Tukhara), which apparently includes the cities of Mo and Han-mo, "has long been deserted and wild. All the towns are ruined and uninhabited." Stein, who explored a part of the central ruins, puts the date of their final abandonment between 719 A. D. and 800 A. D., on the unquestionable evidence of some dated bits of Chinese and Tibetan writing found in a temple. Evidently, the writing was that of pilgrims, or at least of worshipers. The coins which he found, and the style of art, seem to Stein to point to an earlier date as the time of the main occupation of the ruins. Apparently, they were abandoned between 518 A. D., when Sung-yun saw them, and 644 A. D., the time of Hwen Tsiang's visit. A religious establishment, however, persisted, or was reëstablished, after the time of Hwen, and lasted for a century or two. The case seems to be analogous to that of Dandan-Uilik.

The northern, more remote parts of the ruins of Tu-ho-lo appear to be decidedly older than the southern part which Stein visited. In the northern part, called by the natives Kallussti, the entire absence of any trace of houses, the finely broken character of the pottery, and the occurrence of archaic stone hammers and a flint knife suggest great age. In the southern portions, called simply the "Potai," the preservation of portions of the clay walls of houses, the presence of mulberry, white poplar, and other trees still standing in orchards, the greater size and ornamentation of the fragments of pottery, and the occurrence of grooved millstones indicate a later date.

The features of late date are most noticeable in the most southerly ruins. Here I discovered a fort about three miles

south of the main stupa. The discovery illustrates how completely even large and massive ruins may be concealed among sand dunes and tamarisk mounds. On my first visit to Tuholo I hunted for this fort, of which I had learned the approximate location at Endereh, but failed to find it. Later, with a new guide, I tried again, and found a large structure of mud rising twenty feet above us, not over two hundred yards from our previous route. It was completely concealed on one side by a huge tamarisk mound.

From the fort I desired to go straight south to some ruins of which I had heard as being located at Serteck, on the Cherchen road near Baba Kul. Both guides agreed that to get there we must go six miles southwest to Korgach on the Endereh River, twelve miles southeast down the river, and six miles northeast along the road to Baba Kul. That meant a journey of twenty-four miles, which would require two days for the camels. Having never been direct from Tuholo to Baba Kul, the men did not believe it possible to do so. They were utterly incredulous when I said that the distance was only ten miles, and we could reach Baba Kul in a day. They felt sure that we should get lost and would suffer the agonies of thirst. When we finally finished our slow, winding course among a maze of huge tamarisk mounds, we emerged on the open reed fields of the zone of vegetation close to Baba Kul. One guide became as sulky as a spoiled child because his gloomy predictions had proved wrong. The other, an innocent, boyish old man, clapped his hands and, laughing aloud, exclaimed:—

"It's so, it's so. Here we are at Baba Kul. We've come in one day instead of two. The Sahib was right. There is

a short way, and I never knew it. But how did the Sahib know? Have you been here before? No? Then it's a miracle."

The trees among the northern ruins of Tuholo are significant. They prove, in the first place, that a long period of uninterrupted cultivation must have elapsed in order to allow some of them to attain a diameter of four feet. And in the next, they furnish an important suggestion as to the gradual manner in which the oasis was abandoned. Among the older ruins to the north, and even in the centre, near the stupa, the trees have entirely disappeared. This apparently means that they were cut down after the farms had been abandoned. Here, in the latest ruins, however, splendid trees were left standing. Probably the people of this most southerly village, after having cut down the orchards left by their neighbors farther down the river to the north, were themselves obliged to move away and abandon their own trees. The cutting down of all the trees of old Dumuka by the people of new Dumuka is a modern parallel case. If the present Dumuka should now be deserted, its trees would be left as evidence of the progressive abandonment of site after site. Among the Niya ruins, exactly as at Tuholo, valuable trees were left unused among the later ruins, although all were cut off farther downstream, where the farms appear to have been abandoned earlier. The condition of the pottery in the still more ancient part of the ruins, as we have already seen, gives similar evidence that on the Niya and Endereh rivers, as well as on the Chira, the old oases were abandoned little by little, beginning with the remoter portions where the water supply was more precarious.

After the fall of Tuholo, the population along the Endereh River probably was reduced to the little hamlets of which I discovered the ruins at Korgach and Serteck. Later, there was a slight revival, as appears from the ruins of Bilel Konghan, a walled village of about a hundred and fifty houses which I discovered west of the river. The village contains a mosque, which proves that it belongs to the Mohammedan period. The natives have no tradition as to its origin or the reason for its abandonment.

Sometimes they jokingly call it "Nummret Sher," "Poor Man's City," because the main gate on the south side has wooden hinges.

"The Beg of this place was so poor," they say, "that he could not even afford iron for hinges."

The chief importance of Bilel Konghan lies in the fact that it forms a mediæval link in the chain of successively smaller and more decadent settlements which have grown up one after the other on the Endereh River. At the beginning of the Christian era, Tuholo was a large and prosperous town, comparable in size to the modern Chira, but more advanced in the arts, apparently. The houses were well-built structures of sun-dried brick, supported by fine timbers of white poplar, and were admirably adapted to withstand the cold of winter and the heat of summer. Agriculture flourished, and orchards and fields probably surrounded every house. The people were adepts in the art of pottery-making, and their artistic sense, though crude, was so far developed that they ornamented their utensils with designs like those on page 205. Other decorative arts, such as painting, wood-carving, and the moulding of clay and plaster,

were practiced assiduously. Wood-turning was common; writing was apparently so well known an accomplishment that private persons often wrote letters and kept accounts. During the first four or five centuries of the Christian era, Tuholo appears to have lost much of its former size, though it was still a considerable town, with its forts, temple, shrine, and golden statue of Buddha. The old arts prevailed to the end, though the time was at hand when they were to perish.

The fall of Tuholo and the rise of its much smaller and less civilized successor, Bilel Konghan, were separated by the Mohammedan conquest. In more favored places, such as Khotan, the coming of Mohammedanism does not appear to have materially altered the conditions of life or the state of civilization. I doubt whether it did so in the Endereh region. There were certainly great changes, but they were exactly such as would naturally accompany desiccation. In architecture, fine timbers of the carved white poplar were replaced by the knotty, unhewn trunks of the wild poplar, because the increasing salinity of the soil prevented the growth of good trees. Reeds and tamarisks perhaps replaced adobe bricks because when clay becomes saline it loses its adhesive quality. This may account for the decay of the art of pottery-making, which would also be interfered with by the fact that the villages, in moving upstream after water, would necessarily occupy sandy sites, where such good clay could not be procured as farther downstream. The decay of pottery-making would entail that of the subsidiary decorative arts. These were perhaps doomed in any case by the Mohammedan prohibition of pictures. Mohammedanism may have had something to do with the falling off

in the art of writing, and in that of wood-carving, though the latter would be hampered for lack of good material. Other arts decayed in similar fashion, especially agriculture, the greatest of all. Now, in the decadent present, it is practically extinguished. The simple peasants of Endereh, undisturbed by war or religious dissension, have reverted to the pastoral life of their remote predecessors. They build their small huts of wild poplars and unplastered reeds, here and there, as the seasons dictate. All arts are unknown to them save that of spinning the wool of their sheep.

War and the advent of Mohammedanism may explain part of the changes at Endereh. They cannot explain the decay of agriculture, nor the diminution from a population of possibly ten thousand at the beginning of the Christian era to half as much a few centuries later, and then to nothing, nor the mediæval recovery of a rude oasis to a population of less than a thousand, and the present state of pastoralism and a population of only eighty souls. During the nineteenth century, the people of the large western oases of Chinese Turkestan pushed out to find new homes. Advancing eastward from Keriya, they occupied the oases of Oi-Toghrak, Yes-Yulghun, and Niya, and then, two hundred miles farther from their old homes, Cherchen, Tatran, Vash Sheri, and Charklik; but the waters of Endereh and Yartungaz continued to waste themselves in the sand. They had become too saline to be aught but lost.

Endereh is insignificant in itself; it is of great importance as an example of the influence which a change of climate may have upon the habitability of a country, and upon the occupations and character of its people. In Kashmir we

have seen reason to believe that a change of climate caused the people to give up pastoral nomadism and to adopt the sedentary pursuits of agriculture. Such a change must have vastly increased the number of inhabitants. We cannot say exactly what its influence may have been upon their character, but it must have been great. In the far more arid region of Endereh, a change of climate of precisely the same nature caused a reversal of the process. Physical conditions became less favorable, the habitability of the country was diminished, and the dense population of an agricultural community gave place to a few scattered shepherds. If similar results have taken place in other regions, history may have been influenced most profoundly thereby.

From Endereh eastward for two hundred and fifty miles to Charklik, our journey was uneventful. We followed the zone of vegetation quite closely, but zigzagged more or less. Everywhere, in this remote region, there are unmistakable evidences of a great change of climate. For scores of miles where no man lives, we found great tamarisk mounds, dead poplars, or vast beds of dead reeds. All of the few previous travelers who have visited the country have strictly followed the road, which naturally keeps along the southern edge of the zone of vegetation, where alone water is available in shallow saline wells, and where, of course, the vegetation is more vigorous than elsewhere. Hence they have not noticed the unmistakable evidences of desiccation which abound elsewhere.

A hundred miles east of Cherchen we came to the Vash Sheri River, which rushes swiftly down from the mountains, and, after losing most of its volume in the piedmont

gravel, supports the thirty people of Vash Sheri. During the months of June, July, and August, the melting snow on the mountains — thirty or forty miles away — increases the river's volume enormously. Hearing of the large amount of water wasted among reed-beds, a considerable number of people have come to Vash Sheri during the thirty years since it was settled, but most have gone away after a year or two. In summer, they had more than enough water for their fields, but during the planting season of April and May, the supply often ran short. Under the present conditions of climate and irrigation, a population of thirty or forty is all that the river can support.

Long ago, the number must have been many times as great. Formerly, the river followed a more westerly course. At the end of the old channel, and at the same distance as the modern hamlet from the mountains, I traversed the ruins of a Buddhist town covering an area two and a half miles long by one mile wide. Here, as at Niya and elsewhere, the ruins consist of two parts. The older village covered the whole area. Its houses have completely disappeared; but if it were settled as densely as the pottery indicates, or as densely as the modern villages, its population must have numbered five hundred or more. The later village, or the later part of the original village, as the case may be, occupied only the upper portion of the ruins. Traces, sometimes very faint, of sixteen houses can be seen, and some must certainly have disappeared or escaped notice. It is safe to say that near the time of its abandonment the village must have had a population of a hundred souls, — three times as many as the modern hamlet, — and that earlier it must

have had far more. So large a number of people could not be supported to-day without a radical change in the system of irrigation. Fortunately, the river changed its course as soon as the desertion of the village allowed the rude dam of boulders at the head of the old channel to fall into decay. Accordingly, the irrigation works have not been subjected to much destruction by floods, and I found them still almost intact. The difficulty of keeping the river in its old bed may have been the immediate cause of the abandonment of the village, but it had nothing to do with the sufficiency of the water supply of the past as compared with that of the present. The supply depends upon the character and width of the river-bed, which are essentially the same in both cases, the old channel being the wider, if anything. It also depends on the nature of the irrigation system, which, again, was precisely the same in the past as it is to-day. Then, as now, the innumerable minor channels into which the river divides were simply dammed with banks of gravel dug up close at hand. Thus all the water was gathered in a single larger channel on one side of the flood-plain, — a mile wide, — and was led off into canals, mere ditches dug in gravel or sandy clay, as the case might be. If the river should again be turned into the old canals, the available supply of water at the ruins would apparently be essentially the same as that at the village to-day.

CHAPTER XI

THE CHANTOS

CHARKLIK, fifty miles east of Vash Sheri, was the last town in the Lop basin where we came in contact with the Chantos. We had now been among them more than six months. Before proceeding to describe the deserts farther to the east and north, I shall consider some of the more prominent traits of the Chantos, and shall examine the relation of some of these traits to physical environment. The vast majority of the Chantos practice agriculture in the zone of vegetation or in the terrace villages, as their ancestors appear to have done for ages. Their environment is almost exactly the opposite of that of the Khirghiz in the high plateaus. In the zone of vegetation, peculiar physical conditions permit plants of varied species to grow prolifically through a long season in certain strictly limited areas, though elsewhere absolute desert prevails. In the plateaus, on the contrary, physical conditions cause grass, but no other useful sort of plant, to flourish for a short season of two or three months over broad areas. The environment of the Khirghiz compels him to travel continually, and to become a self-reliant, hardy, adventurous nomad; that of the Chanto limits him to one place, where patience and steady work bring success, and where timidity is no special disadvantage.

Crosby, in his book on "Tibet and Turkestan," has pointed out that in the study of history we have not gen-

erally emphasized sufficiently "the special characteristics due to the unvarying fertility, the enervating facility, and the great vulnerability of irrigation systems. Societies," he goes on to say, "have been divided into nomadic, agricultural, manufacturing, and commercial types. The distinction that has not been made and studied in its very important results is that which makes a separate class of the irrigating agriculturist, — safe against climatic risks; crowded in small holdings; dependent on combined action for the construction of irrigation works; the ready victim of any violence which seizes some certain ditch. Contrast him with his brother who lives by the grace of uncertain rains; forced to a prevision which makes the lean year borrow from the fat; able to live wide apart from his neighbor, developing thereby an independent individualism which may ripen into civil order and liberty; each farmer whose land has its own water supply capable of making some military resistance."

In view of the famines of the irrigated lands of India and Persia, and in view of other facts to be presented later, I question whether the irrigating agriculturist is "safe against climatic risks." The highly organized, peaceful condition of many communities where irrigation is practiced raises a presumption that universal dependence on a few canals which are virtually public property may be as effective as "independent individualism" in leading to "civil order." Nevertheless, Crosby's idea that the inhabitants of irrigated oases are subjected to peculiar conditions which give rise to a distinct type of social organization is an important contribution to geography.

Younghusband, less consciously, expresses the same idea

in more specific relation to the Chantos. These people, he says, "are the essence of imperturbable mediocrity. They live in a land where — in the places in which anything at all can be grown — the necessaries of life can be produced easily and plentifully. Their mountain barriers shield them from severe outside competition, and they lead a careless, easy, apathetic existence. . . . They are a race of cultivators and small shopkeepers, and nothing more. . . . It is their destiny, shut away here from the rest of the world, to lead a dull, spiritless, but easy and perhaps happy life, which they allow nothing to disturb."

I have made a list of the qualities of the Chantos which most impressed me, and which I find most frequently mentioned in the writings of others. Among the good qualities, the chief are gentleness, good temper, hospitality, courtesy, patience, contentment, democracy, religious tolerance, and industry; among the bad are timidity, dishonesty, stupidity, provincialism, childishness, lack of initiative, lack of curiosity, indifference to the suffering of others, and immorality. The list might be extended, but so far as it goes, it represents the general consensus of opinion among writers on Chinese Turkestan. It is noticeable that strong characteristics, whether good or bad, are absent. Determination, courage, aggressiveness, insolence, undue curiosity, violence, fanaticism, and the like, are almost unknown among the Chantos. Neither their good nor their bad traits demand any great exertion of will or purpose. On the one hand, there is no public spirit; almost no one exerts himself for the good of the people as a whole. On the other hand, crimes of violence, and even theft, are very rare.

If we examine in detail some of the characteristics mentioned in the list, it appears that hospitality and courtesy are the natural results of gentleness and good temper, combined with timidity. I often felt as if the cordiality of my reception among the poorer people were more or less a cloak for their fears. They brought their best, in part at least, because they dared not do otherwise. We stopped one day at an unusually isolated little farmhouse near the ruins of Choka to ask some questions about the region. While the half-blind old peasant talked with us, his wife, a mild little woman, ran excitedly to and fro. With the help of her daughter-in-law, who kept in the background out of sight, she produced a ragged felt, a bowl of sour milk, and some hot bread, very full of hulls. Being interested, I sat down, whereupon my men asked whether there were no fruit.

"No," answered the farmer in some trepidation, "but," with an air of relief, "there is corn."

After further excitement in the house, the corn was brought to us under the trees, little hot yellow ears, roasted in the husk, and carried from the fire on the extended hand and long sleeve of the old woman. Fifty feet from us she halted, called softly to her husband, and handed it over to him. It would not have been proper for her to come nearer, in spite of her age. As I ate the corn, tough but sweet, the fears of the timid peasants faded. Out of real hospitality, they brought what was to them a great luxury, hot eggs, roasted in primitive style in the ashes. It was worth a day's ride to see the genuine affection of the gentle old couple, and the trustful way in which the man handed over to his

wife our present of three cents. Her glee over the money was equally to be remembered, for it meant as much as a dollar would to a poor farmer's wife at home.

Patience, contentment, and good temper are so nearly universal among the Chantos that it is hard to give concrete examples of them. They are like an atmosphere which one feels so continuously that he ceases to be conscious of it. When I forgot to dismiss men with whom I had been talking, I found that they would stand patiently waiting for an hour. The merchants in the bazaar, and even the little melon-venders in the dusty streets, sit quietly for hours with no sign of restlessness. If you forget to pay a guide to-day, he patiently waits till to-morrow. That the people are contented, as well as gentle and timid, is evident from the readiness with which they submit to any sort of government, no matter how corrupt. When the Chinese retook Kashgar, thirty years ago, after its occupation in the seventies by Yakub Beg, the Turki conqueror from Andizhan in Russian Turkestan, there was practically no fighting. "What soldiers there were," says Younghusband, "when they heard the Chinese were close to the town, hastily threw aside their uniforms, or disguises as soldiers, and assuming the dress of cultivators, walked about the fields in a lamb-like and innocent manner. The Chinese entered the town, and everything went on as if nothing had happened. . . . The shopkeeper sold his wares, and the countryman plowed his fields, totally indifferent as to who was or who was not in power." In regard to good temper, little need be said except that it is the rule among the Chantos. Quarrels, it is true, occur now and then, and the

people are not in the habit of smiling much. Nevertheless, the quarrels are usually mild, though noisy; and one feels that, on the whole, the people are good-natured. The very profanity of the Chantos expresses their mildness. I had some most profane camel-men and guides, but the strongest expression that I heard was, "Damned bad old pig."

In discussing the shrines and hospitality of the Chantos, I have given some illustrations of their religious tolerance and democracy. The former trait is not at all in accord with the general tendency of Mohammedanism, while the latter is highly characteristic of that faith among the people of western and central Asia, but not among those of India. Therefore it is hard to determine to what extent these characteristics are due to religion or to some other cause. Among the Chantos, men of all ranks eat together and share in social pleasures. Great respect is paid to official and religious rank, but even the humblest boy has the opportunity to rise to any post that he is capable of filling.

The industry of the Chantos is a point upon which all writers do not agree. Those who have had the best opportunity for observation, however, such as Shaw, Hedin, and Stein, give the people the most credit. Of course the Chantos are idle in winter, when there is no work which they can do, but they work unremittingly for week after week in summer. My Chanto servants, with one exception, were faithful and industrious. Shaw sums up his impressions of Chanto industry thus:—

"The laborers give a good day's work for a good day's wages. There were some men employed making a melon-garden . . . behind my house at Kashgar. . . . They had

to move a large quantity of earth, and they went at it heartily like Englishmen. My Guddee servants [from India] used to notice how differently they worked from the Indian coolies' listless, idle way. What [three men] did in one day would have taken a dozen coolies to do in the same time. . . . They labored just as hard when their employer, a shoemaker, . . . was out of the way, as when he was present, . . . as I myself noticed."

Turning now to the bad qualities of the Chantos, I have already referred to timidity and untruthfulness. In the latter respect they do not seem to be so bad as some other Orientals, for instance the Kashmiris and Persians. My men, thanks to the fine qualities of their half-breed Ladakhi chiefs, Rasul and Ibrahim, never cheated me at all, so far as I could detect. One annoying trait which the Chanto would probably class under courtesy rather than dishonesty, and which probably is really due to timidity, is the vexatious way in which the native always agrees with any one more powerful than himself, or gives the answer which he thinks the other expects. As Dunmore puts it:—

"If I were to say, 'I suppose it's always hazy and cloudy at Sanju?' — the native would reply, 'Always.' And if [my companion] half an hour afterwards were to say, 'I suppose it is very seldom you get such cloudy, hazy weather here,' the same native would reply, 'Very seldom.'"

Provincialism and childishness are not exactly bad qualities, but they do not add to a people's strength. Whenever we met a wild animal, I was struck with the childish way in which even old men would shout and wave their hands "to see it run." Lack of initiative and of curiosity are to be

called bad only in a mild way. The people do not seem to care to learn to do anything new. They might learn much from their Chinese masters, but no one has sufficient ambition. For instance, more than once I held conversations like the following:—

"Do you smelt copper here?"

"No; we don't know how, but the Chinese do."

This, be it remembered, is after the Chantos have had an opportunity to learn during many centuries of Chinese rule.

The curiosity of the Chantos is of as mild a type as most of their other characteristics. They often marveled at our queer clothes and way of living, but they were never obtrusive, and rarely showed any inclination to examine things closely. At Karaki, one day, on the way from Khotan to Keriya, an unusually curious crowd collected around my door. Though I asked them many questions, no one seemed inclined to ask any in return, until two blear-eyed Chinese workmen, with faces bleached with opium, appeared. When I asked where they came from, they replied, "Urumchi," and at once wanted to know if I had been there, and where I came from. Then two better-educated young Chinese merchants came in. They questioned me so rapidly and intelligently that I almost became vexed at their turning the tables so completely and treating me to my own medicine. When they had admired the lightness of my glasses, the texture of my coat, and especially the convenience of a pen which carried its own ink, all of which it had never occurred to the Chantos to notice, I hinted that I was busy, and both Chantos and Chinese departed most politely.

The Chanto is by no means a hard-hearted man, but he

never has grasped the idea of responsibility for any one except himself or those who can do him good. It was a puzzle to my servants when I told them to find out whether a man lying in the middle of the road was sick, or only tired. In crossing the Karakash River near Khotan, our ferry-boat ran aground a hundred feet from the shore. The poorer people waded to the land, a few richer ones rode on the backs of the boatmen, and I, being a "Sahib," had to forego the pleasure of wading, and have a horse brought to me. In the confusion I saw a woman with a baby fall down in water up to her knees, to the imminent risk of the baby, which might easily have been drowned as the mother floundered to get up. Three or four men and women were near her, but it did not seem to occur to any one to lend a hand.

The saddest result of the weakness of will of the Chantos is immorality, flagrant and well-nigh universal. Khotan and Keriya have the reputation of being the most immoral cities in Asia, and other places are but little better. Not only is there an enormous proportion of women who confessedly lead lives of impurity, but divorce and temporary legal marriages are extremely common. These are so cheaply and easily arranged, and marriage ties are so lightly esteemed, that a so-called respectable woman may have three or four husbands in a year, and a husband similarly may legally marry several successive wives in a year, and two or three score in a lifetime. Of course, in many cases the same husband and wife live together permanently, especially among the peasants, but it is easy to see the deplorable results to which the prevailing system must lead. Dunmore is perhaps putting it rather strongly when he says:—

"Parents seem to have as little affection for their sons and daughters as the children have love and respect for their fathers and mothers; consequently, as soon as the sons are able to take care of themselves, they never look upon their father's house as their home. In fact, such words as 'home,' or 'family ties,' are unknown to these people, who are not capable of forming any legitimate attachments."

Strong family affection certainly exists, as in the case of the little old couple who fed us with corn. My camel-man pleaded for days that his sixteen-year-old son might be allowed to accompany him, and later said, "Thank God, my son is not here to suffer in this desert." Again, our rich host in Khotan sent his son to India in charge of a pious "mulla," that the boy might learn to be manly. Nevertheless, Dunmore's arraignment of the Chantos is largely correct. Their weakness of will has led to practices which utterly destroy the sanctity of family life, and utterly prevent the growth of the higher, sterner virtues.

In endeavoring to judge fairly the most notable traits of the Chanto character, we are confronted by the question of their origin. It is easy to dismiss them as innate racial traits, but that answers nothing. No one believes that the ancestors of any race possessed exactly the qualities which the race now possesses. The question to be answered is: What part of the Chanto character is due to religion, what to contact with other races, and what to physical environment? I cannot answer it. I only propose to give certain reasons for believing that physiographic environment has been an important factor.

While there can be no doubt that Mohammedanism favors

immorality and various other forms of weakness, it would be unfair to attribute all the vices of the Chantos to that cause. Various tribes of Arabs, Turkomans, and even Khirghiz have relatively high standards of morality, although they are stricter Mohammedans than are the Chantos. They preserve the standards as long as they retain the nomadic habit, though, significantly enough, they are said by the Russians and others to begin to deteriorate when they settle into an uneventful oasis life like that of the Chantos, and I myself saw evidences of this in Russian Turkestan.

The essential fact in the life of the majority of the Chantos is that they live in densely populated, but small and isolated oases. Their surroundings are pretty and attractive, but not varied enough to be inspiring. A short period of hard labor suffices to provide sustenance for the whole year, and the rest of the time is given over to prolonged idleness, with leisure for more of evil than of good. The population of the Lop basin is strictly limited by the water supply. The people possess a great advantage over those of most irrigated countries, however, because the loftiness of the mountains causes the maximum flood to come in midsummer. Hence, though few in number, the people live in comfort. In most irrigated countries, such as eastern Persia or Transcaspia, for example, the mountains are so low that the snow largely melts at the end of winter, and the maximum flood comes in the early spring when the grain is being sown or is beginning to grow green. Thereafter the water supply decreases until fall. Every drop is hoarded. Most of the water must be given to the grain fields, which produce the main support of life. Very little is left for fruit trees and vegetable gardens,

and almost none for trees to be used as fuel and timber, or for plants for forage. In good years, the average poor inhabitant of Transcaspia or Persia raises grain enough for his family, and a small supply of fruit and vegetables, sufficient for his own needs, but usually not enough to sell. He cannot feed much live-stock, at best only a couple of donkeys or oxen, and three or four sheep or goats, if he is fortunate. His only fuel is weeds, laboriously gathered by the women and children, or dried dung, with which he ought to manure his fields. It suffices to cook his bread in out-of-door ovens, but not to warm him or his house. He has practically no means of getting anything but a bare sustenance — bread, with a little milk and a few vegetables, and more or less fruit. Only with the greatest difficulty can he scrape together enough produce to sell at the local bazaar in exchange for clothes to keep him warm in his fireless mud hut in winter. He is always on the verge of starvation, and has no hope of change.

In the Lop basin, conditions are far more favorable. The amount of grain that can be profitably sown, and hence the population, is limited by the spring water supply as absolutely as in Persia, but fortunately the supply keeps increasing as the season advances. The maximum flood from the loftiest mountains does not come till June. The amount of water is then so great that not only do even the poorest farmers have enough and to spare, but a large amount goes to waste and aids the underground water in supporting the reeds, tamarisks, and poplars which characterize the zone of vegetation. When once his grain has been sown and watered, the Chanto has little anxiety, for he knows that, however

bad the season, the increasing flood will at least support the fields upon which he mainly depends. With the surplus water of midsummer he can raise all the fruit and vegetables that he wants, and can have a grove of poplars for timber, some walnut trees for nuts, mulberries for silk-worms, and fields of alfalfa for hay, of cotton for clothes, and of corn to supplement the wheat. Meanwhile, without care on his part, the surrounding zone of vegetation is producing various plants which in winter provide him with abundant firewood for himself and with grazing for the animals which, perhaps, have spent the summer in the rich pastures among the mountains. However poor he may be, he can always raise a little more than the bare necessities of life; he can vary his diet with abundant milk and some meat; and he can have plenty of fuel and warm clothes of quilted cotton or sheep-skin.

The Chanto peasant, unless he is also a shepherd, has no reason to travel beyond the neighboring bazaar. His friends are near at hand. In summer, when the desert on every side is hot and deadly, his garden and the shady village streets are cool and pleasant. In winter, when it is cold and dreary outside, his house is well heated and comfortable. There is nothing to tempt him out of his small oasis; nothing to waken him or to arouse determined effort. His work in summer may be hard for a time, but it rarely hurries him, or causes him anxiety. He knows that the water will be turned into his ditch on such a day: his crops must be cut at such a time, and all the family must work, but bad weather never seriously interrupts the harvest, and a delay of a day or two will do no harm. And so year after year, and generation after generation, the Chanto goes his care-free, monotonous

way, and grows gentle and mild and weak of will. He has no contact with the world outside his own oasis, and therefore fears whatever is new or strange. The Chanto's mind is so habitually idle, — that is, it receives so little stimulus from his ordinary surroundings, — that new sights and new ideas do not interest him, and he is strangely free from curiosity, nor does his easy, quiet life often tempt him to quarrel. In winter, he sits idle with nothing to occupy his thoughts, and naturally eating and drinking and the pampering of his body become the chief things in life. It would be strange indeed, if, under the given physical conditions, the Chanto were other than the courteous, submissive, self-indulgent creature that he is.

To nullify the evil influences of the physical environment of the Chantos, two influences may prove helpful, namely, the stimulation of variety of scene, and of steady work. The shepherds get something of both, and, in their way, seem to be better men than the peasants. And even in the cities, where the worst elements gather, there are, as we have seen, occasional men of real strength of character. In the future, great changes may perhaps take place, for the Lop basin has immense undeveloped resources. Chief among these is the vast amount of water wasted in the zone of piedmont gravel. Only a fraction of the water which flows out of the mountains reaches the oases, probably not half in the western portion of the basin, and not a tenth in the eastern portion. The Yartungaz, Endereh, and Molja rivers, east of Niya, support practically no population, though they are as large as the Niya River, which, in spite of enormous preventable losses, supports nearly five thousand people. The Kara

Muran, still farther east, though as large as the Keriya, which supports about fifteen or twenty thousand, is entirely unutilized; and there are many other equally significant cases. The difficulty is that the water never comes to light after sinking into the piedmont gravel, or if it reappears in springs in the zone of vegetation, it has become too saline for use in irrigation. If hard-bottomed canals of concrete could be constructed, such as those now being built in the western part of the United States, both difficulties would be avoided. The present oases could be greatly increased in size, and new ones could be opened. The tremendous fall of the water among the mountains ought to be utilized for manufacturing purposes. The abundant cotton, silk, and wool of the oases could be converted into cloth; the fruit and vegetables could be preserved, and the milk made into butter and cheese. And beside all this, the mountains contain gold and other useful metals.

When all the possibilities of the Lop basin are utilized, its capacity to support life will be vastly increased. And perhaps it is not too much to hope that the conditions of life will then be changed for the better. The isolation of each separate oasis will tend to disappear; life will become broader; and the necessity for steady work and greater self-control will arise. Moreover, another and probably more potent influence is likely to be felt in the further influx of another race with new ideas, which must take place if the resources of the basin thus expand. It is hardly to be expected that any occidental nation should take much interest in so remote a region. If China, however, follows the example of Japan, and wakens to self-consciousness, the great unpopu-

lated arid regions of Mongolia and Turkestan on her northern and western borders will offer easy and promising avenues of expansion, analogous to those presented by our own arid southwest. Development will probably nowhere take place more rapidly and surely than in the Lop basin, for nowhere else does so much water go to waste.

CHAPTER XII

THE UNEXPLORED SALT DESERT OF LOP

SIX hundred years ago, Marco Polo found one of the worst parts of his great journey from Italy to China in the desert of Lop east of Charklik. For thirty days, so he tells us, he traveled northeastward, over sandy plains and sterile mountains, through a desert inhabited only by evil spirits, which were said to lure travelers to destruction with extraordinary illusions. If, during the day, the Venetian says, any one should remain behind till the caravan had passed out of sight over a sand-hill, he would unexpectedly hear himself called by name in a familiar voice. Thinking the call to come from friends, he would follow it away from the road, and soon be left to perish of thirst. In the night, which, especially in warm weather, is the best time for journeying, travelers might hear the march of a huge cavalcade close at hand. Believing it to be their own party, they would follow it, only, at daybreak, to find themselves lost in the desert. Sometimes the spirits were said to assume the appearance of a body of armed men, who filled the air with the sound of musical instruments, drums, and the clash of arms, frightening the timid travelers so that they fled helter-skelter into the desert, to lose themselves and die of hunger and thirst.

The Chinese, also, tell wonderful tales of the desert of Lop. They speak especially of a part consisting of boundless muck, which swallows up man and beast. And the Lopliks, or people of Lop, who live at the western end, tell sterner

stories of the torture from thirst, the frantic search for water, and final death of the few of their number who have attempted to cross the desert in summer or fall, when the scanty water supply is in most places undrinkably saline. Yet in ancient times, up to the second or third century of our era, Chinese records show that the main trade route from China to the West traversed this now desolate region.

Such contradictory statements suggest that great changes have taken place during the past two thousand years, and so, too, does the fact that on ancient Chinese maps Lop-Nor is located a degree north of its modern position. This latter circumstance has given rise to much controversy. Przhevalski and other Russians, on the one hand, hold that the modern lake, the Kara Koshun of the natives, can properly be identified with the ancient Chinese lake of Lop-Nor; Von Richthofen and Hedin, on the other, hold that it cannot. Question has also arisen as to whether the ancient expansion of Lop-Nor, of which there is unmistakable evidence, persisted into historic times, or had come to an end before man occupied the country. In the hope of contributing something toward the solution of these questions, I planned to travel completely around the unexplored part of the ancient lake, crossing the Lop desert in its widest part. As a result of the journey, I became convinced that two thousand years ago, the lake was of great size, covering both the ancient and the modern locations; then it contracted, and occupied only the site shown on the Chinese maps; again, in the Middle Ages, it expanded; and at present it has contracted and occupies the modern site.

Now, as in Marco Polo's day, the traveler must equip

his caravan for the desert at Charklik, also known as Lop, two days' journey southwest of the lake. The little town of twelve hundred Chantos and Lopliks, reinforced by a Chinese garrison, seemed quite a metropolis after our two months in the almost uninhabited region to the west. Our four busy days there were enlivened by a case of justice which shows the respect paid to foreigners. Ibrahim and several local men of influence came to my room excitedly one day, bringing with them Handum Bai, our camel-man, whose face was covered with blood, and a sullen merchant, who had lately come to Charklik from Handum's home in Keriya. It appeared that the merchant owed money to Handum. He admitted the debt, but when the camel-man insisted on his settling the matter, he refused to pay more than a small part of what the other claimed. A hot dispute ensued, and finally, so it was alleged, the merchant set on Handum, and knocked him down in the bazaar. The camel-man did not seem to object to having a black eye and a bloody mouth. What troubled him was that he had been assaulted in the sight of all the people. I proceeded to hold a trial to determine how much money was really due, and who began the fight. Angry Handum made a vigorous plaintiff, the sulky merchant an unpromising defendant, and the most venerable of the local gray-beards a sapient jury. I served as judge, and everybody played counsel. When the witnesses were called to testify, every one began to shout at once.

"Sh! Sh!" said the gray-beards. "Where do you think you are? This is not the bazaar, but the house of greatness."

By dint of much persuasion, we induced the witnesses to

speak one at a time, and to address me instead of arguing with one another. When I began to write down the gist of what they said, a look of surprise went over the crowd, and the old men murmured admiringly: —

"Ah, see that! He is writing. Now we shall have justice."

The evidence left no doubt as to the guilt of the defendant. He owed Handum two dollars instead of thirty cents as he claimed, and it was he who began the fight in the bazaar. When I pronounced judgment, he sent his frightened nephew home in great haste to get the money. For the sake of a lesson to the people, I let the prisoner be kept in custody till the local Beg could be summoned. He came at once, putting aside all business.

"This merchant," I said to him, "has assaulted my camelman causelessly in the sight of all your people. Please take charge of him and do what is right."

An hour later, a message came from the Beg.

"I have inquired into the matter with stripes." The messenger added that according to the request which I had sent privately, the prisoner had been dealt with leniently, "with stripes not many or painful, but enough to serve as a warning." The warning was timely, for I planned to leave two men and all the horses in Charklik for two weeks; and after our experiences of the obstructiveness of the natives at Keriya, it seemed well to have the people know that my men must be treated respectfully whether I was present or absent.

On December 23, I started eastward once more, along Marco Polo's track. The caravan consisted of three of my own men, a Loplik guide, and five camels. We had forty-five days' provisions, chiefly in the form of mutton, rice,

bread, onions, and tea for ourselves, as well as a quantity of linseed cake to be fed to the camels, when necessary, at the rate of two pounds a day. For personal luxuries, there were raisins, eggs, and chickens, but in general my fare was no better than that of the men.

For the first three days, our way led eastward along the gravel at the southern edge of the zone of vegetation to Miran, or, as the natives often say, Miyan. The Miran River rises in typical fashion in the main snowy range of Kwen Lun, breaks through the front range in a deep gorge, traverses the piedmont gravels in a terraced trench, and disappears during much of the year in a broad flood-plain of gravel. Where the river enters the zone of vegetation, I discovered the ruins of a large town. Perhaps "discovered" is not the right word. The famous Russian explorer, Przhevalski, had long before recorded the fact that a ruined fort is located at this point on the map. He climbed a tamarisk mound near the cultivated fields of Miran, and with a field-glass saw the walls of a fort a mile or two away. He did not visit it, nor describe it, nor give any idea of its size. Accordingly, it was a great surprise to me on Christmas day, 1905, to find myself encamped among the ruins of a large town.

Geographically, Miran closely resembles Vash Sheri. The reasoning applied to the one applies with increased emphasis to the other. Archæologically, Miran is far more important. The ruins are not only much larger, but a new type of architecture is developed, the chief structures being elevated ten or twenty feet on solid pedestals of sun-dried brick. At present, Miran is not permanently inhabited. The fisherfolk of

Abdal, on Lop-Nor, twenty miles to the north, come in summer to cultivate the reedy fields, and, by using all the water available in spring, raise grain for about fifteen families. The fields can be cultivated only once in three years, for in a single season of irrigation, a cake of clay two or three inches thick is deposited — a cake so stiff that crops cannot grow in it until it has been softened by two years of sun and rain. The natives think that the clay is gathered after the river begins to spread over the huge gravel flood-plain, ten miles long and one or two wide. In reality, the river is charged with fine clay when it leaves the mountains, where it is said to be equal to the river which supports the large village of Charklik. On reaching the flood-plain, the water sinks rapidly into the coarse gravel, but, as the current is swift, the fine clay is borne along, until at Miran the river is literally a stream of mud.

Formerly, conditions must have been far different. The old Buddhist Miran was neither a hamlet, such as to-day might be located here, nor a village like old Vash Sheri, but a town. It covered an area of at least five square miles, all of which, judging from the canals and pottery, and still more from the number and location of public and religious structures, must have been thickly populated. The houses, being made of clay, have disappeared, with two exceptions. Thirteen other structures remain, of which one is a fort, four hundred feet square; one is a lamasery, the outer walls of which are adorned with clay reliefs of Buddha; two are stupas, or shrines; and the other nine are solid rectangular masses of sun-dried brick, capped in most cases by the walls of what may, perhaps, have been monastic dwellings, or Buddhist

temples. These establishments appear to have been kept up after the prosperity of the town had vanished, as I infer from the extremely flimsy nature of the repairs superposed upon the solid structure of the older part of the fort.

Ancient Miran, in its prime, must have required a water supply many times as large as that now available. It is reasonable to suppose that, being the most important place for hundreds of miles, from both a religious and a military point of view, Miran had an irrigation system as good as the country afforded. The water at first came from an old river-channel east of the town, and later, apparently, from the present channel on the west. The dams and canals are preserved as at Vash Sheri, and do not differ from those of to-day. The main older dam is composed of tamarisks and small boulders thrown loosely together; and there is said to be another, which I could not find, composed of boulders alone. The canals are either simple ditches, or are raised a few feet upon dykes. In every case, the material is that which happened to lie close at hand. On the upper Miran River there are no inhabitants, and no opportunity for the diversion of part of the water. The present supply, sufficient for fifteen or twenty families, is all that the river is capable of furnishing under the system of irrigation which prevails now, and was in vogue in Buddhist times a millennium or more ago. If the rainfall were increased, say, by half, the amount of water reaching Miran would be multiplied in far larger proportion. Being confined to a single channel, the water would scarcely suffer more loss from evaporation and from sinking into the ground than it now does, and all the extra supply would be available at Miran. The diffi-

culty from the excessive amount of sediment would vanish. Though the absolute quantity of sediment might conceivably be greater than now, it would be diluted with a far larger amount of water, and spread over a much larger area. The hard cake would be reduced from two or three inches to perhaps a quarter of an inch, not enough to interfere with cultivation. Miran, even more than the other ruins, seems to verify the hypothesis of a change of climate during historic times.

After staying at Miran two days, we turned to the north, and a day's journey brought us to Abdal, on the bank of the Tarim River, near Przhevalski's Lop-Nor, or the lake of Kara Koshun, as Hedin prefers to call it. This hamlet is occupied by Lopliks, a clear-skinned, dark-haired people, probably Chantos with a large admixture of Mongol or Tibetan blood. They talk a Turki dialect but little different from that of the Chantos, like whom they dress. They have the same gentle, hospitable ways as the rest of the people of the Lop basin, but seemed to me more independent and self-respecting. I was amazed at the way in which some of them drew maps of roads, lakes, and rivers in the sand, representing the proportions and directions correctly to a degree rare among uncivilized people. Perhaps their ability comes from the necessity of keeping in mind the exact length and direction of the multitudinous and intricate canals and little lakes of the reedy swamp of Kara Koshun. They make their living as fishermen, paddling their dug-out canoes of poplar from pond to pond through narrow lanes bordered by reeds. Till eighty years ago, or less, when Charklik was founded, or better refounded, none of the Lopliks practiced agricul-

ture; according to their own account, they all lived on fish, waterfowl, and eggs, with a change in the spring to the soft tips of reeds and rushes, but never a taste of bread. At that time, and still more in earlier days, the number of Loplik fishermen was many times as great as the present total population of two hundred and fifty. The diminution, according to their own story, is due to the gradual drying up of the rivers and lakes, and the consequent decrease in the number of fish. Part of the people have moved away, so they say; part have died of small-pox. They fear this disease so intensely that when any one is supposed to be ill with it, they put food beside him, and then flee to a new village, abandoning their reed houses, and even their scanty furniture.

At Abdal, I was quartered in the single mud house among a dozen reed huts. The kindly people, knowing of our approach, and perchance thinking of the vast hoards of money supposed to belong to all Sahibs, had chopped a hole through a foot or two of ice, and caught some fish. I asked to have them cooked and served in Loplik fashion. Presently the mistress of the house appeared with a steaming bowl of fishy unsalted water.

"What's this?" I asked.

"Why, that's the way you wanted it — our way. We always drink the water that the fish have been boiled in."

I omitted the Loplik first course that day, though the boiled fish were excellent.

The fact that a woman should set food before a strange man showed that Mohammedan law is not strictly observed here. The greater freedom of home life was refreshing. It was like a breath from the west when a girl of twelve, who

elsewhere would have hidden her face in the end of her sleeve and run away, rubbed her head against the arm of a young giant of twenty-five, and teased: —

"Big brother, let me do it."

He was showing me how fishing-nets are made from the fibre of the "Lop plant," which, by the way, is one of the finest fibres in the world, as much tougher than hemp as hemp is than cotton. Other things, such as the absence of mosques and of daily prayers, showed that we had reached the extreme limit of Mohammedan influence. Ibrahim, who was a most devout follower of the Prophet, was disturbed because, as he said, "The Lopliks are good people, but they don't have much work with God." At Keriya, when first I mentioned Lop, he had asked if it were true, as people said, that the Lopliks wore nothing but the skins of wild animals, and that they were such adepts in the art of eating fish that they could put in the meat at one side of their mouths, and at the same time spit out the bones at the other.

On leaving the friendly Lopliks, we entered what is probably the greatest uninhabited continental area in the world, outside the polar regions. In an area equal to that of Great Britain and Ireland, where the population numbers forty million, there is not a single inhabitant. Much of it has never been visited by any explorer, or even by the natives. For thirty days of steady traveling, we saw absolutely no sign of living man. Except in rare cases, there was no vegetation which even camels could eat, and no water save bitter pools. By traveling in the dead of winter, when the temperature fell to zero every night, and by carefully chopping out and melting blocks of hard, white ice from the midst of the yel-

lowish, mushy material covering most of the pools, we managed to get water which, in that part of the world, is called drinkable. We were troubled with thirst most of the time, and the indigestion caused by the salt water lasted a month or two after we ceased using it. No creature but the wild camel can drink the wretched liquid habitually. Even upon that hardy animal it has a marked physiological effect. In Kuruk Tagh, after leaving the Lop desert, I once dined on wild camel. The meat was fairly good, like very coarse beef. Though perfectly fresh, in one sense of the word, it had become distinctly "corned" because of the salt which had accumulated in the animal's body from the water.

For eight days eastward from Abdal, we kept close to an old strand of Lop-Nor, following a caravan road used about once a year. To the south, barren gravels stretched interminably toward the mountains; to the north, the brownish-white expanse of the old lake-bed stretched sullen and unexplored to a sea-like horizon, or faded to nothing in dusty haze. Nothing relieved the monotony except a sharp lacustrine bluff, sixty feet high, rising suddenly from the insignificant zone of vegetation. The zone was a mere strip of brown reeds, dotted with bright-blue pools of brine, unfrozen because so saline. At Koshalangza we halted to make preparations for the plunge into the utterly unknown region to the north. I estimated from the map that, barring accidents, we ought to reach the salt spring of Altmish Bulak in six days. The spring lay ninety miles away in an air line, at the foot of the Kuruk Tagh, or Dry Mountains. There was no knowing, however, what delays we might encounter, or how long we might have to hunt for the spring. In such bit-

terly cold weather the camels could go ten days without water, or, at a pinch, twelve. Accordingly, we cut twelve days' supply of ice, and tamarisk fagots enough to last eight days if used very sparingly. This, with thirty days' provisions, twenty days' linseed cake, and the camp equipment, made the camels' loads so heavy that it was impossible for any one to ride.

We were anxious about the camels, for they had now traveled three months on comparatively poor food with no long rests. The smallest, a truly pretty little animal, had lately developed huge and evidently painful red blisters on its soft padded feet. To prevent its becoming useless, the men cut off the upper portion of a pair of high, native boots, such as we all wore, and cleverly converted the lower parts into camel-shoes. The poor animal screamed like an angry, frightened child when the men tied its legs together, and rolled it over on its side; but it seemed decidedly grateful when, on rising, it found that its feet were no longer so painful. We were nearly overcome with laughter, for the little camel shook its ungainly feet as a cat does hers when a small boy ties papers on them; and then walked off with its hind legs a yard apart.

A hearty laugh was good for the anxious men. At Charklik I had told them that we were going to a difficult and dangerous region where no man had ever been, and they could turn back if they wished.

"No," they answered, "we have seen that with a piece of paper and a 'Mecca-pointer' [compass] you can find a road where there is none. If we die, we die. Allah is merciful."

At Koshalangza I gave them another chance to go back, but they swore that they were not afraid.

For four weary days we stumbled northward across the interminable salt plain of the old lake-bed. An ordinary frozen plowed field would have seemed like a macadam road in comparison. Imagine the choppiest sort of sea with white-caps a foot or two high, and freeze it solid. When we camped in what we hoped was a soft spot, and tried to drive in the iron tent-pegs, most of them bent double. We had to use an axe to hew down hummocks of rock salt a foot high before we could get places smooth enough for sleeping. Each night when we pulled off our soft-soled boots, — the only kind in which we could keep warm, — we realized what effect the bastinado must produce. The slowness of our stumbling progress, the boundlessness of the sea-like horizon, the bitter morning wind, and the uncertainty as to when we should find something different made us feel that the old lake-bed must be endless.

The roughness of the salt plain may be explained as follows: During the long-continued process of drying up, the ancient lake of Lop deposited an unknown thickness of almost pure rock salt. When the salt finally became dry, it split into pentagons from five to twelve feet in diameter, the process being similar to that which gives rise to mud-cracks when a mud-puddle dries up, or to basaltic columns when lava cools. The wind, or some other agency, apparently deposited dust in the cracks; when rain or snow fell, the moisture brought up new salt from below; and thus the cracks were solidly filled. When next the plain became dry, the pentagons appeared again. This time the amount of mate-

rial was larger, and the pentagons buckled up on the edges and became saucer-shaped. By countless repetitions of this process, or of something analogous to it, the entire lake-bed became a mass of pentagons with ragged, blistered edges.

Twice we encountered faint, broad hollows, where for a mile or two the plain was damp and comparatively smooth. Traveling in such places was much easier than elsewhere, but, remembering the Chinese tale of muck which swallows horse and rider, we avoided them as far as possible. It was well that we did so. Nothing could be more dangerous than these smooth, soft places which felt so comfortable to our weary feet. A few days later, beyond the main body of the lake-bed, we came upon a small, isolated salt plain which, as we progressed, assumed a fresher, whiter appearance and began to look slightly damp. I was riding the biggest of the camels, whose load of wood and ice had now been partly used. Suddenly I found myself turning a somersault backward off the animal. His hind legs had broken through the saline crust, and had plunged a yard deep into soft, oozy muck. As he struggled ponderously to extricate himself, his front legs also sank in; and oily water came bubbling up in muddy pools about the prostrate creature's belly. Two other camels fell into the mire at the same time. In the haste with which we began to tear off their loads I forgot to investigate whether my neck was broken. Relieved of their burdens, the two smaller camels extricated themselves. My big, heavy animal, however, was so completely mired that we had to put ropes around his legs and pull his feet out on to felts, which we had spread on the soft mud to keep him from sinking in again. It was a grim jest on the part of nature to lead

us into an unfrozen, watery salt-bog in zero weather, in a region so cold and dry that we were carrying ten or twelve days' supply of ice for drinking-water. If the mud had been a little softer, we should have lost the camels and perhaps ourselves. If we had ventured to traverse the soft, smooth areas to the west of our line of march across the great salt plain, we should probably have found ourselves in danger of being swallowed up on every side, and might never have returned to corroborate the Chinese tales of bottomless muck.

On the fourth morning of our weary march, we were cheered by encountering a shore-line, marked by a steep bluff thirty feet high. On climbing to its top, we supposed that we had left the old lake-bed behind. After walking a quarter of a mile among æolian mesas of clay, however, we dropped down another bluff, and were in the salt plain again. We had crossed a finger-shaped peninsula, ten or twenty times as long as it was wide. All that day and till noon of the next we encountered similar peninsulas, or elongated islands, separated by bays and sounds of similar dimensions. The axes of all were directed northeast and southwest, as the map shows. Apparently, during a dry interfluvial epoch preceding the last marked expansion of the lake, the violent winds of the region, which prevailingly blow from the northeast, had carved out great hollows between countless mesas, as they are doing now in many other places. Later, when the lake again expanded, it penetrated the hollows and widened them into a network of parallel sounds and bays, dotted with an archipelago of elongated islands and peninsulas. The flat-topped islands, with steep red and green bluffs

surrounded by the clear blue water of the bitter sea, must have presented an uncommonly unique type of scenery.

Beyond the fatiguing plain of salt, we found easy traveling for a time. A fantastic red plain, the soft, dry bed of an older expansion of the lake, glittered with innumerable gypsum crystals, or was again sparsely studded with weird æolian mesas from thirty to sixty feet high, made of horizontal layers of pink and greenish clay. On the sixth day, the red plain gave place to a maze of mesas. As we were traveling at right angles to their long axes, we were obliged to make countless huge zigzags in order to find breaks through which the camels could pass. Nevertheless, we made fourteen miles that day, and by sunset were close to the mountains of Kuruk Tagh, and only four miles from Altmish Bulak according to my estimate, or eight as it afterward proved to be. Shortly before we camped, a cheer went up from the men.

"Wood has come! wood has come!" they shouted. Sure enough, a few bits of driftwood lay in a long-dry flood channel. It was the first sign of life, or of the work of running water, that we had seen for six days. No, not quite the first sign of life. We had found in the salt a half-buried plover, dead for centuries, ever since the time when the bottom of the lake was still soft and formed the muck of the Chinese tradition; and elsewhere, in the side of a mesa, we had seen the deeply buried roots of some reeds which flourished long ago in the expanded Lop-Nor of one of the earlier glacial epochs. Otherwise, for nearly a hundred miles, the entire country was as barren as a well-used road.

"We came just as though we had been here before," said

the men when we reached Altmish Bulak on the seventh noon. The camels had suffered from hunger more than from thirst. In spite of seven days without water, they would not drink till they had filled their stomachs with reeds and prickly camel-thorn. For ourselves, the greatest difficulty had been lack of fuel. The night temperature had averaged nine degrees below zero Fahrenheit, with a minimum of seventeen below. Two or three sticks, fed slowly together, had not made a very satisfactory fire, but we dared not use more for fear of some delaying accident. Some nights I had to write with a pencil, because my fountain pen froze in my hand, though I held it as close to the fire as possible. One night I actually had to eat dinner with my plate in the fire to keep the food from freezing. Yet, thanks to vigorous exercise, none of us suffered from cold, except when the wind blew.

At Altmish Bulak we rested a day, chopping new ice, cutting fagots, and getting ready for a start the next morning toward the ruins of Lulan, thirty miles to the southwest. When Handum Bai went to bring in the camels, he could not find them, though he and the others searched till dark. Only one remained, the little foot-sore animal, which we had kept at home that afternoon to have its shoes patched. During the next twenty-four hours we watched and tended that camel like a sick child. The chances were that we should never find the others. If we threw away everything except food, furs, and instruments, and abandoned all hope of further exploration, the weary little animal might be able to help us to Tikkenlik, the nearest settlement, a hundred and fifty miles away. If it became exhausted, as there was every chance of its doing, or if it succeeded in its vigorous attempts

to run away and seek its mates, we should be in a sorry plight. If we should have to go on foot to Tikkenlik, carrying even the minimum of food, furs, and ice, and following a circuitous route in order to hunt for springs at the foot of the mountains of Kuruk Tagh, it would probably take us twelve, or perhaps fifteen days to get there. Failure to find water, sickness, or untoward accident, such as injury to the compass, might mean that we should never get there.

I decided to spend two days in hunting for the camels, and then, if we were unsuccessful, to try for Tikkenlik. The track of the runaways must be visible somewhere in the soft sand or gravel. I told the men that when we found the track, the discoverer was by no means to go off alone in that vast pathless desert, but to come back to camp for a companion, and for food and ice. During that anxious night, it was hard to refrain from repeatedly getting up to make sure that the little camel had not escaped. In the morning, we found that Handum Bai had gone off alone, nobody knew when or where. We finally found his track, and that of the camels, leading off to the southwest down the slope of piedmont gravel. It did not deviate to right or left like the track of animals in search of food, but ran straight away as though the creatures had been led. Handum's track showed that he had been running, an amazing thing for an Oriental to do. Ibrahim and our Loplik guide followed the track some miles, but came back at three o'clock with no news. As Handum had opened none of the food-bags, and had left his coat in camp, I began to feel more anxious about him than about the camels. If he lost his way, or went too far, a night without food, water, fire, or furs, and with a temperature of ten

degrees below zero, after a day of severe exertion, would probably kill him. Accordingly, I started the two men off again, with the tired little camel loaded with everything necessary, including fagots and ice. They were to follow Handum's track till dark, camp where their fire could be seen from afar, go on till near night the next day, and then, if neither Handum nor the camels had appeared, turn back, leaving a cache with his coat, and plenty of wood, food, and ice.

The Ladakhi cook and I remained in camp. Abdur Rahman, as he was called, feeling lonely and disconsolate, prepared for the hoped-for return of his companions by cooking the favorite Ladakhi dish, lumps of highly spiced, heavy dough boiled in fat, and eaten if possible with buttery Himalayan tea. Coming to my tent after sunset, ostensibly to tend the fire, he was whiling away the time by telling me about it when we heard a faint halloo borne on the strong west wind. Hurrying to the top of a bushy hillock, whither our anxious feet had worn a path that afternoon, we peered into the darkness, and, after vainly shouting into the teeth of the wind, kindled a big fire. At last, after a disquietingly long interval, the voice sounded again, near at hand, and in a moment the firelight showed Handum Bai, with bowed head, striding wearily through the reeds with the huge two-humped camels behind him.

He was out of his head. Fatigue, hunger, thirst, and anxiety had unsettled the poor man's wits, never any too keen. All that we could gather was that he was trying to explain why he had gone off alone, contrary to orders. The next day he was able to give a more coherent account, though it was weeks before he was himself again. Apparently, the camels

would not have run away if Handum had heeded the cook's warning that they were beginning to stray at three o'clock of that fateful day. At bedtime, eight o'clock, Handum Bai was in anything but a pleasant frame of mind.

"If the camels are lost and we die here in the desert," he told us that he had said to himself, "it will be my fault. This is the mating season, and our camels have surely gone off after the wild camels which come here to drink. They may go a hundred miles without stopping. If I wait till morning, and go with another man, the camels will have such a start, and we shall go so slowly, that we shall never catch them. The Sahib will be angry if I go alone, but he will be still more angry if the camels are lost and we all die."

Waiting till the moon rose, between nine and ten o'clock, he stealthily crept out, taking nothing but some matches. How he found the track I do not know, but find it he did, and ran beside it all night. Once his unprotected hands got so cold that, finding a small bush a foot high, he stopped to make a little blaze. At the same time he ate a bit of snow which had been preserved under the bush, the last remnant of a couple of inches which had fallen six weeks before, during the only snow-storm of the winter. Otherwise he neither ate, drank, nor rested.

"I vowed when I started," he said, "neither to eat nor drink till I found the camels, or got back to camp. And I vowed to run all night as hard as I could, and to spend the day in coming back to camp. I knew it would take all day to come back if I ran all night, because it would be uphill. And I knew a night in the open would kill me."

It was well that Handum Bai acted as he did. The un-

deviating track, and a wild camel seen by him, left no doubt that our animals had been led off by wild ones. Ours probably never came near the others, for it is well known that the wild camel is extremely afraid of anything which suggests man; for instance, the saddles which we always allowed to remain on the animals' backs during the winter to keep the creatures warm. Two of our camels fought on the way, as Handum Bai knew from the tracks. Fortunately, the saddle of the big leader was knocked off, and, becoming caught to the animal's hind foot by a loose rope, not only acted as a clog, but made a broad track, easy to follow. At daybreak, Handum entered a region where the wind had cut the clay plain into little mesas like those described above, only more thickly set, a hopeless labyrinth of narrow passages. He despaired of finding anything, and was about to turn back. Suddenly, however, he spied a dark spot, conspicuous among the pale green and gray of the region. It was the big camel's head rising over a table of clay. The saddle had stuck in a narrow passage between two elongated mesas, and the animal was caught in a veritable trap. He bit so furiously that Handum could not catch him, and was obliged to go off for the others, which, deprived of their leader, were straying slowly not far away. Finally, with a rope from the neck of a small camel, he caught the big one, and was ready to return. As he looked around to find how to get back to camp, he suddenly noticed the sun rising in the *west*, as it seemed to his confused mind, and wondered what the evil spirits were doing. He started off, however, on his old track, only after half an hour to find himself back where he started. He rubbed his eyes. The spirits must be

leading him, he thought. He had sense enough to examine all the tracks carefully, and discovered that he had followed his own track made in catching the milder camels. If the spirits had been clever enough to raise a little wind and cover the tracks, it would have been the end of Handum Bai, and, perhaps, of the rest of us. As it was, he chose the right track. Once he tried to ride, but found it too cold. In the late afternoon, he foolishly attempted to make a short cut, thus failing to meet the other two men, and almost getting lost again. Toward sunset, he thought that over the rock-ribbed plain of gravel he saw the reedy plateau of Altmish Bulak, rising ten feet above the surrounding dry flood-plain. After dark, he supposed himself near camp, but hearing no answer to his repeated shouts, was about to pass on and camp near the mountains, perhaps to perish of cold. He was planning, so he said, to make the four camels kneel in a square, and crouch down in the middle out of the wind. Then our fire flared up far to the right, and he was saved.

The two men whom I had sent off with the feeble camel found Handum Bai's track the next day, and returned in the afternoon without incident. Judging by what I later saw of the topography, the man must have traveled twenty-five miles each way in his chase after the camels, — fifty miles in twenty hours without food or water. The experience was to me a revelation of the inexorableness of the desert. It was still more remarkable as an illustration of the intensity and endurance which lifelong contact with the desert in the care of his camels had developed in Handum Bai, a man of the mild Chanto race. None of my other men would have done so hardy a deed — only Handum, who from early child-

hood had endured heat and cold and fatigue in the desert, far from the enervating influence of the easy agricultural life of the fertile oases. Such intensity is often supposed to be a result of Mohammedan fanaticism and fatalism. More probably it is the result of life in the desert. There none succeed except those who, though often lazy and dilatory, are capable at times of becoming almost monomaniacs, fanatics, animated by the will to do some deed in spite of heaven or hell.

CHAPTER XIII

THE DRY RIVER AND THE DRY MOUNTAINS

OUR journey from Altmish Bulak to Tikkenlik was wearisome because of the æolian mesas and the sand dunes, but otherwise it was not difficult. On the first day, January 17, we fell into the muck, as described above — a piece of good fortune, as I soon saw. We had evidently stumbled upon the last remnant of one of the four little lakes marked on ancient Chinese maps as lying in an east and west line north of ancient Lop-Nor. That night, after a détour of two miles to the east, we camped near the old lake shore among some huge red and green æolian mesas, a hundred feet high. Around us in every direction, smaller mesas, only ten feet high, were capped with traces of old reed-beds, which must have covered a broad plain surrounding the lake. While the men, in a hunt for firewood, were picking up pieces of the rare poplars and tamarisks which once dotted the plain, I spied some sticks on top of one of the biggest mesas; and after a dusty scramble, found that they were parts of an ancient reed "satma," or shepherd's hut. A millennium or two ago, some Buddhist peasant, from Lulan perhaps, watched his sheep feed among the reed-beds far below, while he lay idly in the shade above the heat and flies of the jungle, and cooled by fresh breezes from the blue lake. Half a mile away, his neighbor, or his master, had built the good-sized house which I found that same night on the top of another great mesa.

The following day, we traveled eighteen miles to the ruins of Lulan, discovered by Hedin. Everywhere we found patches of pottery and other signs of human occupation. On leaving the ruins, which Hedin has described most minutely, we again found pottery for a distance of fifteen miles, until we left the area of dead vegetation and entered the zone of piedmont gravel north of the Kuruk Dariya or Dry River, an old bed of the Tarim River, which once brought life to the country before it was diverted southward to Abdal. Forty miles farther west, we again crossed to the south side of the Kuruk Dariya, and at once found pottery and other signs of human occupation. During the first few centuries of the Christian era, luxurious vegetation and prosperous villages covered the country for scores of miles, as may be seen on the map; to-day, all is desolation, not a trace of verdure, not a sign of any living thing, nothing but unending stretches of weary mesas, large and small, studded with the stubble of reeds, the dead trunks of poplars, and the gnarled remnants of old tamarisk mounds. Here, perhaps, more than in almost any other part of the Lop basin, the signs of desiccation are unmistakable; but they must be interpreted with care, for the Tarim River could again be brought here.

On the morning of January 24, eight days after leaving Altmish Bulak, we saw the first living poplars since leaving Abdal four weeks before. By three o'clock, we reached a great line of sandy mounds fifty feet high, shrouded in a most vigorous growth of tamarisks, unmistakably a rampart built up by the wind along the northeastern edge of the zone of vegetation, which is supported by the interlacing Konche and Tarim rivers Our month of guideless wandering among

salt plains, old lakes, labyrinthine mesas, and dead cities was over; ahead of us lay life and the land of fresh running water, in place of death and the land of scattered salt springs whose water we loathed. We wondered silently at the contrast between the landscapes on the two sides of the great tamarisk barrier. To the east lay an infinitely varied monotony of intricate mounds and hollows, some composed of yellow or reddish sand, and others of clay, white, pink, and pale green — faint, dull colors, broken only by the dark spots of dead tamarisks and the gaunt skeletons of perished poplars: to the west, a smooth, rich river plain, extending as far as the eye could see, orange, yellow, or straw-color in the reedy portions, dark purple where tamarisks prevailed, and a delicate grayish brown among the splendid poplars.

"You said there were no people here," was the men's first comment. "How can that be? There must be people in a place with all this wood and water and good land." And I too marveled that what looked so fair should be uninhabited.

We found a sheep-trail the following morning, but it came to an end after a mile or two. Most of the day we struggled in a pathless wilderness, making the hardest march of the whole journey. Occasionally we zigzagged pleasantly among poplars and tamarisks; often we made vexatious détours around the frozen shores of rush-filled ponds; but most of the time we painfully forced a way through thickets of reeds and tamarisks twelve feet high, and so dense that at every step we had to force the stiff, dusty stems apart. Toward evening, we succeeded in getting out of the jungle into the comparatively open area of dead vegetation between

the Ilek branch and the main stream of the Konche River. There, once more, to my surprise, we found pottery scattered about. The ancient villages must have been very widely distributed. The following day, we avoided more ponds, which, like all the rest, were four or five feet lower than the shore-line marking what was said to have been their level in 1900. Columns of smoke had been visible in the distance ever since we first came in sight of vegetation, but the distance seemed interminable. Finally, however, toward noon of the second day, we reached a fire not far from the Konche River. A timid shepherd in cap, coat, trousers, and boots of ragged, undressed sheep-skin was engaged in burning off the reeds so that his flocks might feed on the tender young shoots in the spring. He left his chubby, five-year-old son to carry on the work, while he cheerfully led us to the Tikkenlik road. When we parted, he laughed aloud with pleasure at the unexpected good luck which gave him a coin to put in his mouth, and some bread to stow away in the top of his big cap.

Tikkenlik proved to be a scattered little village. Its five hundred inhabitants, Lopliks and Turfanliks, live partly in mud houses and partly in houses of reeds. It is notable as being the only permanent village, as distinguished from tiny fishing and shepherd hamlets, on the lower four hundred miles of the Tarim River, or the lower two hundred and fifty of the Konche; and it is the only place where there is any serious attempt at agriculture. It is essentially the modern representative of Lulan. The two may fairly be regarded as measuring the success of their respective ages in utilizing the dwindling lower portion of the stream whose headwaters

drain all the western and northern portions of the Lop basin. As we have already seen, there is no reason to believe that the ancient inhabitants of the basin were more skillful in the art of irrigation than their modern successors. Because of their isolated location, neither Lulan or Tikkenlik has ever suffered very greatly from war, and great disasters have not been due to human causes. Manifestly, the present condition of Tikkenlik is far inferior to that of ancient Lulan. This may be due either to a lack of settlers and of enterprise, as is usually assumed in such cases, or to physical causes. Let us examine conditions to-day as compared with those of two thousand years ago.

Previous to 1889, there was nothing which could properly be called a town, or even a respectable village, on the lower Tarim and Konche rivers. The only inhabitants were a few fishermen and shepherds, whose temporary dwellings and crude utensils of skin and wood leave only the slightest traces, not at all comparable to the houses and pottery of Lulan. In 1889, a Chinese amban, seeing so much good land and water going to waste, as he thought, attempted to found a town. He dug a canal and opened a tract of land at Jan Kul, thirty miles west of Tikkenlik, on the Tarim River. People from Turfan, Korla, Kucha, and elsewhere flocked in to get land. By 1890, the population numbered over two thousand; and Jan Kul, as the people say, "became a town," that is, a bazaar was established and an amban installed. Almost immediately, however, the fields became saline, and in 1892 the place was abandoned, most of the settlers returning whence they came. Meanwhile, in 1891, about a thousand people had come from Turfan to Dural, eight miles

south of Tikkenlik on the Konche River. Accordingly, a large fort was built there, and in 1893 the amban of Jan Kul was removed to Dural, which in turn "became a town." For three years the "boom" continued, but by 1897 the soil had become so saline and the crops so poor that the colonists began to move away. In 1898, to offset this loss, over two thousand rebellious Dungans were induced, or forced, to come from Shi-Ning, eight hundred miles to the east, and settle at Dural. The water was so saline, however, and new land so quickly became unproductive, that in 1900 they migrated ninety miles northwest, to Kara-Kum, another site which had just been opened on the Konche. Thereupon, in 1901, the amban was removed to Kara-Kum, and in 1904 the last and poorest of the people of Dural abandoned it and came to Tikkenlik. Kara-Kum became even larger than its predecessors, and from 1901 to 1903 is said to have had a population of five thousand. Nevertheless, the salt proved as bad there as elsewhere, and in 1904 it, too, was abandoned, though the amban and forty or fifty people still remained at the beginning of 1906. Jan Kul, Dural, Kara-Kum, and Tikkenlik represent four abortive attempts during sixteen years to utilize the water of the lower Tarim and Konche rivers. The attempts are especially significant because they failed at a time when the rivers of Turkestan were unusually high, about 1900, as well as when the rivers were low, about 1893. Tikkenlik, being but four or five years old, still survived in 1906, but it was deteriorating. Its five hundred people were either moving away, or else betaking themselves to sheep-raising or fishing, the means of livelihood of the former hamlet before the attempt to establish a town.

They told me that Indian corn, one of the great staples of Chinese Turkestan, will not grow at all. It is replaced by a large-grained variety of white millet. Wheat fares better, but only the first year. If a given field is cultivated two or three years in succession, it becomes worthless. Evidently, the permanent occupation of the lower Tarim and Konche regions by a fixed agricultural population is, under present conditions of irrigation, impossible even at Kara-Kum, the site farthest upstream. At Lulan, over two hundred miles farther downstream, where evaporation has had still more opportunity to concentrate the salt in the river, conditions must be much worse. The complete failure of the Chinese attempts was not due to misgovernment, or to war, or to lack of settlers eager for land; but entirely to the extreme salinity of the rivers.

Turning now to the past, we find that though the difficulties of the present prevailed in early times, they were much less acute. At one period or another, as is proved by the pottery which I found, a permanent and somewhat dense population occupied a tract extending at least a hundred and twenty miles east and west along the dry bed of the rivers, and having a width of from ten to forty miles. The people were not shepherds, for keepers of sheep do not carry large quantities of breakable pottery with them from place to place. They must have been permanently settled, and presumably they practiced agriculture. The date of the densest population is uncertain, but from the absence of structural ruins over a large part of the pottery-strewn area, it is probable that the pottery represents a very early time, possibly some centuries before the Christian era.

Macartney has gathered the earlier notices of Lulan from Chinese sources. According to the "Tsien Han-shu," or "History of the First Han Dynasty," Lulan came into intercourse with China between B. C. 140 and B. C. 87. When the history was written, at some date between B. C. 100 and A. D. 50, the district had a population of 1570 families, 14,100 people, with 2912 trained troops — fifteen or twenty times as great as the population to-day. The land, according to the history of the Hans, is "sandy and salty, and there are few cultivated fields. The country relies on neighboring kingdoms for cereals and agricultural products. It produces jade, abundance of reeds, the tamarisk, the clococca, and white grass. The people remove their cattle for pasturage wherever they can find sufficiency of water and herbage. They have asses, horses, and camels. They can manufacture weapons like the people of Tso-kiang." This sounds as though there were but little agriculture. There appears to have been some, however. In B. C. 77, the king of Lulan, Hui-Tu-Chi, petitioned the Chinese emperor to establish a military colony in the city of E-tun, where, he said, "the land is productive and rich." The emperor sent forty cavalrymen "to cultivate the fields at E-tun, and soothe the people."

Our next information as to Lulan is derived from certain manuscripts and other articles found by Hedin in the ruins. The written documents date from about 264 A. D. to 270 A. D., and probably indicate approximately the time of the abandonment of at least the particular group of villages in question. Coins found in the ruins belong to two kinds, one struck between B. C. 118 and A. D. 581, and the other between

A. D. 9 and 23. Some of the manuscripts have been deciphered by Himly, who says: —

"The inhabitants [of Lulan] must . . . have been engaged in agriculture, for one of the principal items in the manuscripts consists of weights and measures of seed-corn; some of them also name this or that kind of corn. Possibly there once stood on the site where the manuscripts were found an old revenue office, or a sort of 'grain bank' [such as those now found in China], where grain was bought and stored, or received as security for loans." Other manuscripts state that "such and such a quantity of seed-corn has been handed in, or so many men have been furnished with provisions for a month." One runs thus: "The approaching army is to be met at the frontier [or at the shore] by forty officials; and the farmsteads are many."

Later information as to Lulan is given by the pilgrim Fa-hian, A. D. 400. According to Beal's translation, he says: "The country of Shen-Shen [Lulan] is rugged and barren. The clothing of the common people is coarse, and like that of the Chinese. . . . The king of this country honors the law of Buddha. There are some four thousand [?] priests." Finally, Hwen Tsiang, A. D. 645, merely mentions the name of Lulan, or Nafopo, as a place through which he passed; but apparently it was of no importance. In view of the facts recorded above, and of various historical notices of the wars of Lulan, which it would be tedious to relate, it appears that two thousand years ago, more or less, the Lulan region was for century after century inhabited by a settled population many times as dense as that of to-day. The critical question is whether such a population could persist so long and attain

so high a degree of civilization, if they lived as the present inhabitants do, with practically no agriculture. On the one hand, we have the unequivocal statement that "there are few cultivated fields. The country relies on neighboring kingdoms for cereal and agricultural products. It produces jade, . . . and the people manufacture weapons." This may mean little or much. One might say with perfect truth, "England has but little cultivated land. It relies on America and Australia for grain. It produces coal, and the people manufacture iron and steel." This would not mean that there was no agriculture in England. On the other hand, we have the mention of people sent "to cultivate rich and productive land." Again, "seed-corn" and "many farmsteads" are mentioned. Neither Hedin nor I found any trace of canals or of ancient fields, which indeed would hardly be expected. He, however, found some wheat straw, suggesting that agriculture had been carried on; and I found some eleagnus trees, and a considerable number of large trunks of the white or cultivated poplar, lying with part of their roots where they had fallen. The timber of the larger houses is white poplar, so the tree must have been common. It never grows wild in the Lop basin, and is sensitive to salt. Its presence is unequivocal evidence that irrigation, and hence agriculture, was carried on continuously in one place for periods at least long enough to allow of the growth of trees two feet in diameter. On the whole, it seems safe to say that, although the river was probably so saline as to make agriculture difficult, conditions were distinctly more favorable than at present. In a case such as this, there is danger that an author's prepossessions may determine his

opinion as to the adequacy of evidence for or against his favorite theory. Two things, notwithstanding, seem to me to present insuperable obstacles unless we accept the theory of a secular change of climate. In the first place, if there has been no change, why did many thousands of the people of the past succeed so well in making the country habitable, while the people of to-day have failed utterly in the same attempt? In the second place, the agreement of the phenomena of Lulan with those of other parts of the Lop basin indicates that the same changes have affected the whole country.

Before leaving Lulan, the trade routes which formerly passed through it deserve notice. According to ancient Chinese records, the main caravan route from China to the west came from Su-Chow through Sa-Chow (Tung-Hwang) to Lulan. There it divided, one branch going to Kashgar by way of Khotan and the south side of the Lop basin, and the other to the same place by way of Ak-Su and the north side of the basin. Up to about the third century of our era, the road from Sa-Chow to Lulan was of great importance. It contributed to the prosperity of Lulan, as appears from the results of Himly's study of certain objects and manuscripts found there by Hedin. Himly says: "The objects appear to have belonged to a wealthy Chinese merchant, who supplied commodities of every description, let out carriages and beasts of burden on hire, besides conveying letters to Tun-Kwang [Tung-Hwang, Sa-Chow]. Travelers going to the latter city used horses, carriages, and oxen." A hundred and twenty-five years later, in 400 A. D., the pilgrim Fa-hian, who followed the same road, says of it: "In this desert

[between Lulan and Sa-Chow] are many evil demons and hot winds: those who encounter them all die without exception. There are no flying birds above, no roaming beasts below. Everywhere as one gazes, as far as the eye can reach in search of the onward way, it would be impossible to know the route but for the dead men's decaying bones which show the direction." In the course of a few centuries, a great change apparently took place, causing the abandonment of one of the chief trade routes of antiquity in favor of one much longer, but better supplied with water. Hedin found what appear to be the cairns marking this ancient road, and also another set branching from the main route about halfway from Sa-Chow to Lulan and leading off to the northwest, probably to Turfan. When I crossed the line which the old main road must have followed, I picked up a flat ring of iron about two inches in diameter, apparently part of a bridle. In the region where the road was located, Hedin's camels had to go eleven days without water, and mine seven. Even if the Tarim River followed its old course to Lulan, the traveler who attempted to follow the ancient road from Sa-Chow either to Lulan or Turfan would be obliged to make a waterless march of over a hundred miles. It seems highly improbable that one of the main trade routes of antiquity from China to the west ever followed such a course, especially when a better was available farther to the north or south. It would be most surprising if a man of Lulan made a business of letting out horses and oxen to perish on such a road. If, however, the climate of antiquity was such that the number of springs was larger, and that the existing salt springs were

fresher than now, the location of the road becomes highly reasonable.

Two short days' journey northward from Tikkenlik brought us to Ying-pen, the ruins of a little fort and village discovered by Hedin on the ancient trade route west of Lulan. The population was evidently very small, perhaps ten or twenty families. Hedin thought that the water supply came from the Dry River, not far to the south. As the ruins lie sixty feet above the river on the fan at the mouth of the Bujentu valley, the supposition is not tenable. It would require a canal ten or twenty miles long, of which there is no trace; and such a canal would be out of all proportion to the size of the village. The only other alternative is that the water should have come from the Bujentu valley, which leads southward from the Kuruk Tagh or Dry Mountains. Accordingly, I went up the valley, and found a canal, which I followed for two miles to its head. It was simply a ditch dug in gravel, and protected on either side by a row of tamarisks, long since dead. I also found a reservoir with walls of gravel in which the water was stored near two of the shrines called "stupas." Like all the other ancient irrigation systems which I saw, that of Ying-pen differed not a whit from those of to-day. At present, the place is uninhabited. When I questioned some antelope-hunters who often visit the region, they said that where the Bujentu valley leaves the high mountains, there is an old fort called Shindi, on an ancient road, apparently, from Lulan to Kara-Sher. At this point the valley always carries water, which reaches Ying-pen only in flood. There is not enough, however, to support a single family. If there were, some of the people

who had to leave Jan Kul, Dural, and Kara-Kum would have used it. Yet, formerly, the water of the Bujentu valley supported a small village. Here, as in other cases, there appears to have been a mediæval, or Mohammedan period of revival after the earlier abandonment of the site by the Buddhists.

North of Ying-pen rises the steep escarpment of Kuruk Tagh. At its top there is said to be a district which, though called "Davan," or "Pass," is in reality a gently rolling, grassy pasture land, the eastern prolongation of the Tian Shan plateau. In order to avoid this, we made a détour to the east to Kuzzil Singer. The scenery was almost identical with that of eastern Persia so far as the main physiographic forms were concerned. We traversed desolate plains of barren gravel, from which rose low, half-buried mountains, worn into rounded shapes if viewed as a whole, but extremely sharp, jagged, and naked if examined in detail. Some of the hills were wonderfully streaked with patches of red and white shale, which had been enclosed in the black mass of ancient and now much faulted lava flows. The whole region was made up of gravel-filled basins, in which the gravel had often risen so high that it covered the lower passes of the mountains. Long ago, when there had been less deposition of gravel, the basins were separate. Now they have coalesced, and all drain, or would drain if they had water enough, into two main salt plains, or ancient lakes, named Ugunnto and Uzun Bulaki Shor. There are no permanent streams east of the high plateau, and the few springs are for the most part saline. The region is well called the Dry Mountains. It is a typical example of the

influence of prolonged erosion under conditions of great aridity.

At Kuzzil Singer we were the guests of four Chanto brothers, camel-hunters. They and their families are the only inhabitants of the whole region for nearly a hundred miles in every direction. It was they who killed the camel on whose flesh we dined one day. They shot it at Altmish Bulak, where our animals ran away. One of the brothers, the oldest, Abdur Rehim by name, came with us as guide. He led us westward along the northern base of the plateau of Tian Shan to Lake Bagrash Kul. This large lake is peculiar in its archipelago of enormous sand dunes, three or four hundred feet high, standing in the water at the eastern end. Apparently, at some time, the river of Kara-Sher, now the main feeder of the lake, flowed to Korla without entering the lake. Naturally, the water shrank to a low level, as is evident from the dunes which accumulated in what had been the lake-bed. Now the water has risen, apparently because the river has been diverted to it again. We crossed the lake on the ice in a day and a half. There for the first time since leaving Niya, almost five months before, we had the feeling of being in a region where man predominated over nature. On the ice we met carts full of wood and charcoal from the mountains, and driven by surly Dungans. Beyond the lake we came upon encampments of Mongols almost hidden in the grassy plain. And soon we met the Chantos and Chinese of the dirty, mongrel town of Kara-Sher.

Although the Dry Mountains and the Chol Tagh, or Desert Mountains, to the north of them are almost uninhab-

ited, they furnish their own peculiar evidence of desiccation. I saw traces of ancient habitation at Pochinza, near Kuzzil Singer, and at Kumush, a little farther north, but they were too small to be conclusive. At Chukur, north of Bagrash Kul, we passed some ruins, and the people said that there are traces of old canals which indicate that centuries ago the fields were two or three times as large as those which can be cultivated to-day. Similarly at Ushak Tal, in the same vicinity, I found that the main ruins of an old Buddhist village lie four or five miles below the centre of the modern town, at a point to which the present stream will not run at all in dry winters, and only in a very small volume during dry summers.

For Kuruk Tagh and Chol Tagh as a whole I cannot do better than quote from Abdur Rehim, the guide of Kuzzil Singer. My own limited observations agreed entirely with his. Abdur Rehim was a tall, lank hunter, who for the forty years of his life had lived in the desert, far from all neighbors except his brothers. He knew every mountain, plain, and spring within a hundred miles of his home, and every spot where a little vegetation flourishes, or rather perishes, in a damp spot surrounded by salt. His lonely life, and his long, hard journeys after game, had given to him, as to his brothers, a degree of energy and self-reliance which I have never seen equaled in Central Asia. And more than this, he was a man who, though he talked but little, thought deeply.

"In old times, were the springs larger or smaller than now, or were they just the same?" I asked him one day.

"Larger," he answered without hesitation; and when I

questioned why, he went on, without prompting or further questioning, to say: —

"When I was a boy and first went with my father to hunt, or to care for sheep, all the springs were larger than now. Where they now flow a quarter of a mile, they then flowed half. Reed-beds that are now a foot high were then two, and there were more of them. And there were more wild animals; we saw three or four then for one now. I think it must be because there is less water. It used to rain hard enough to form running streams six or seven times a year, and now it does so only two or three."

After speaking thus of the decrease in rainfall during the past four or five years, without taking due account of the difference between the impressions of a boy and of a man, he went on to something more important and reliable.

"And long, long ago, before the time of my grandfathers, perhaps in the days of the old forts at Ying-pen and Pochinza, there must have been much more water. In the high mountains there are many places where little stone shepherds' huts, with the roofs all fallen in, stand in valleys where nobody has ever known of there being any water. And all around them are the droppings of cattle. The nearest water is sometimes five or ten miles away. Surely nobody would ever build a house in such a place. So I think there must have been running water in the valleys when the houses were built. How many such houses have I seen? Oh, many. I never counted, but the mountains are full of them.

"And then, away from the great mountains there are dry springs everywhere, places where the salt deposit of a spring

and a few reeds can be seen. No one has ever known of there being any water in these places, but from every side old paths of camels and antelopes come in, just as they do to places where there is always water. The animals used to come to the dry springs regularly to drink. Now, nothing ever visits them except a stray animal once or twice a year to eat the few reeds. Near almost every one of the dry springs there are little shelters made of rocks and tamarisks, just such as we make now when we lie in wait for game. Nobody would make those beside a dry spring. They were made long ago: we don't know by whom.

"Nobody ever asked me about this before, and I have never talked of it. But I have seen many things when I have been hunting, and have thought about them. So," —according to the Turki idiom, —"that's what I know in my stomach."

CHAPTER XIV

THE WAXING AND WANING OF LOP-NOR

IN traveling through the Lop basin we have everywhere found evidences of pronounced changes of climate during historic times. It will now be well to sum up the evidence, and to ascertain how far the conclusion which we have reached is in accordance with the phenomena of Lop-Nor. The most widespread proof that there have been climatic changes during the last two or three thousand years is found in the death of vegetation over large areas. On the lower slopes of the Kwen Lun Mountains the dissected condition of deposits of loess shows that a cover of grassy vegetation prevailed at no remote time, but has now died. In the zone of vegetation, for a distance of seven hundred miles, plants of all kinds show signs of drying up: the tamarisks usually stand upon mounds; the poplars are dead or dying except in the moistest places; and beds of dead reeds cover scores of square miles. It has often been asserted that in many parts of the world the destruction of forests has been the cause of a diminution of rainfall. In the Lop basin, it is manifest that the opposite has been true: a diminution in the water supply has been the cause of the destruction of forests. Another line of evidence shows that ancient roads such as that from Keriya northward, or the great trade route through Lulan, have been abandoned because there is now no water along them. Again, in the Dry Mountains and elsewhere, springs once frequented by animals or by men have

now disappeared. Both to the north and south of the Lop basin, regions which once were the home of nomadic shepherds are now uninhabited because there is not enough water and grass.

When we turn to the rivers, it appears that in the seven hundred miles from Khotan eastward, seventeen are worthy of notice by reason of their size or because they support oases. Of the seventeen all but four come to an end in the zone of vegetation, and hence it is impossible to determine whether they have diminished in length. The remaining four all once flowed from eight to twenty-five miles farther into the sand than they now do, as appears from dead vegetation. Thirteen of the seventeen rivers have on their lower courses the ruins of towns dating from the Buddhist era, a thousand or more years ago. In almost every case, the ancient towns were larger than their successors, this being notably true of Niya, Yartungaz, Endereh, Cherchen, Vash Sheri, and Miran. And finally, with the possible exception of old Cherchen, Charklik, and Karadong on the Keriya River, the older ruins are situated so far out in the desert, or upon rivers so small or so saline, that it would be impossible again to locate towns of equal size in the same places, unless a far better system of irrigation were introduced. There is not the slightest trace of such a system, although if it had existed, its canals would surely have been more durable than those built under the present crude system. Moreover, in three places, Vash Sheri, Miran, and Ying-pen, almost the entire irrigation system of old times is preserved, including both dams and canals; and it is evident that the ancient methods of utilizing water were precisely like those

of to-day. The abandonment of the ruined towns cannot have been due to the encroachment of sand, for in some places, such as Miran, Vash Sheri and Ying-pen, there is no sand; in others, such as Endereh, the amount is small; and even in places such as Dandan-Uilik, where there is much sand, it appears to have encroached upon the inhabited area after, not before, the vegetation had begun to die for lack of water. It is possible that in one or two minor cases the diminution of the water supply may have been due to the diversion of part of the headwaters of a stream, but in most cases this is impossible. Manifestly, such diversion in one place would cause a larger stream and more abundant vegetation elsewhere; but as a matter of fact, the amount of vegetation has diminished everywhere. Neither the theory of the diversion of tributaries, that of the encroachment of sand, that of the former existence of a better irrigation system, nor that of the destruction of forests offers any explanation of the fact that many streams have grown much more saline. This can be accounted for only on the theory of a change of climate, a theory which not only is in harmony with all the known geographic facts, but which also explains many of the events of history.

We have seen that in the Lop basin, as in Kashmir, desiccation has not been a steady process. Fluctuations or pulsations have been the rule, some large and long, some slight and short. From the third to the sixth century of our era, there seems to have been a time of intense aridity succeeding a period of relatively abundant moisture, during which the rivers and hence the population were much larger than at present. During the time of aridity, many old towns

were abandoned, including Rawak, the major part, if not all, of Dandan-Uilik, Karadong, the Niya River town, Tuholo, Lulan, and possibly others whose dates are as yet unknown. At the same time, the great trade route through Lulan was given up in favor of a longer one. At a later date, roughly between the ninth and the sixteenth centuries, there appears to have been an epoch of somewhat more favorable climatic conditions. Choka was built on the Karatash River; Kenan and Lachinata, as well as Chira and Gulakhma, flourished lower down on the main stream; a road existed across the desert north of the present end of the Keriya River; Bilel Konghan grew up to succeed Tuholo; and Ying-pen, which appears to have been abandoned by its Buddhist builders, was reoccupied by Mohammedans. During the last few centuries, as the vegetation shows, there has been again a tendency toward aridity.

If the climatic pulsations outlined above have actually taken place, the level of Lop-Nor ought to have fluctuated in harmony with them. Apparently it has done so. The problem of its fluctuations is complicated, however, by the fact that the location of the lake has varied in response to changes in the course of the Tarim River. Hedin, by means of a careful survey with a transit, has proved that the western part of the old bed of Lop-Nor contains two slight depressions. One of these, the more southerly, is occupied by the present lake, which the natives call Kara Koshun. The other lies just south of Lulan. During the early centuries of the Christian era, the Tarim River, which then watered Lulan, discharged into this northern depression. It doubtless filled it and formed a large lake, which included the other depres-

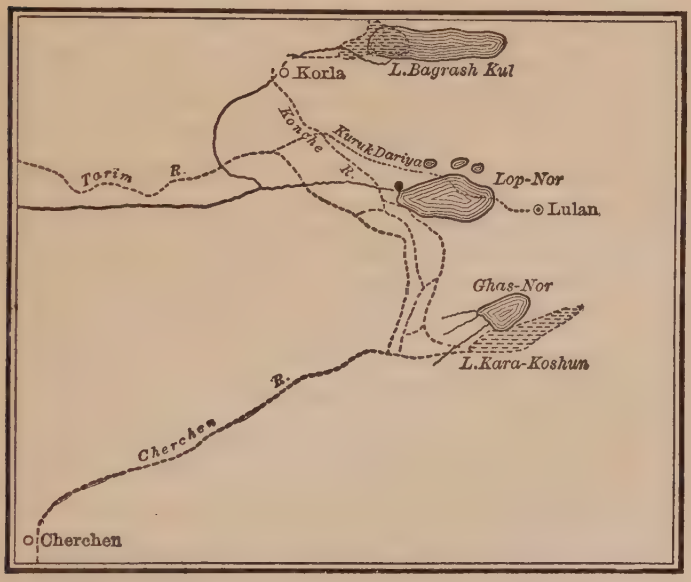
sion also; for in those ancient days Lop-Nor was called *the* "Great Salt Lake." No one would think of calling it so to-day, for the greatest expanse of open water is only five or ten miles. As to a somewhat later time, we have the evidence of the earliest Chinese map, which is reproduced on page 285. The exact date of its compilation is not known, but it was certainly after the fall of Lulan, for that place is not indicated; and it was certainly many centuries ago, for the Tarim is represented as still following the course of the Dry River. The Tarim discharges into the northern depression, where it forms what is represented on the map as a relatively small lake, not much larger than that of to-day. The southern depression is occupied by a still smaller lake, called Ghas-Nor, and fed, we suppose, by the Cherchen River.[1] In course of time, the Tarim River left its old bed and occupied one after another of the various channels shown on the map, being deflected continually farther and farther to the right, so that now, for several centuries, it has discharged into the southern depression.

Hedin believes that the cause of the right-handed deflection of the Tarim River is to be found partly in a supposed, but as yet unproved, motion imparted to the water of all rivers by the rotation of the earth, and partly to the unquestionable effect of the prevailing northeast gales in driving the water in erosive waves against the right bank of the river, and in filling up the left side of the channel with wind-blown sand. It seems to me that the peculiar action

[1] Hedin, it should be said, adopts quite a different interpretation, and supposes Ghas-Nor to represent a lake far to the south on the Tibetan plateau.

of the Tarim River is in part due to another cause, which also explains the sudden bend to the east in the lower part of the Cherchen and old Kara Muran rivers.

During an extremely dry inter-glacial epoch, the river probably withered to nothing far upstream. On recovering



MODERN EDITION OF AN ANCIENT CHINESE MAP, AFTER WAGNER AND HIMLY

The dotted lines indicate the modern location of lakes and rivers. The solid dot shows where Lulan would be located if it were inserted in the ancient map.

its length, in a somewhat moister time, it apparently found that to follow the zone of vegetation eastward parallel to the base of the mountains was easier than to break southward through the rampart of sand on its border. Thus it acquired an unstable peripheral position, where it flowed

across instead of down the main slope. If such were the case, whenever the stream accidentally broke through the retaining wall of sand, it would swing to the right. It would thus gradually assume a normal course in the lowest part of the basin.

Coming now to evidence as to variations in the size of the lake, we have first the ancient name, *the* Great Salt Lake. The old Chinese, however, also called Lop-Nor a "marsh," and the "Lake of Reeds," which seems very contradictory, unless these names were applied during the arid period after the fall of Lulan. The history of the first Han Dynasty, written, it will be remembered, about the beginning of the Christian era, gives the size of the lake as seventy-five miles each way. At this time, Lulan must have consumed much of the river for irrigation, which would naturally lessen the area of open water. A later record of unknown date, but perhaps belonging to the centuries of great aridity, gives the size of the lake as only fifty miles by twenty-five, and another as one hundred miles in circumference, which comes to nearly the same thing. Whether these figures refer to the entire marsh, or only to the area of open water, is uncertain. Hedin gives the size of the modern Kara Koshun as seventy-five miles by eighteen, including all the marshy tract, which, he says, comprises nine tenths of the entire area. Przhevalski gives sixty or seventy miles by thirteen, but his map diminishes this. So far as any conclusion is justifiable from such meagre data, it appears that, in the very earliest times, Lop-Nor was larger than now, in spite of the greater population known to have existed then on the Tarim and its upper tributaries. Somewhat later, at an

unknown but early date, the lake seems to have been of much the same size as now, as appears from its being called a marsh, and from its representation on the old Chinese maps.

In the succeeding Middle Ages, there is reason to believe that Lop-Nor was again decidedly larger than now. In an old local account of Tung Hwang (Sa-Chow), which Rev. G. W. Hunter of the China Inland Mission kindly translated for me, he found an itinerary of the ancient trade route, already referred to, from Tung Hwang to Lulan. Lulan, however, is not mentioned, and the whole country appears to have been almost uninhabited, apparently because the itinerary was not written till after the abandonment of that region. At a distance of one hundred and eighty miles (seven hundred and ten li) from Tung Hwang, this "very important road," as it is called, is said to reach a lake called Cho-hu-tong, apparently Lop-Nor, which, so the account goes on, is connected with the Ta-leng-mu (Tarim) River. This would necessitate the expansion of the lake to a point eighty miles east of Lulan, and fully fifty from the present eastern end of the Kara Koshun marsh. The water would have to rise nearly, or quite, to the twelve-foot strand.

Other facts agree with the itinerary. Grenard speaks of having seen at Keriya a Chinese map dating from the eighteenth century, but probably based on earlier surveys. It showed Lop-Nor in its present position, but very much larger than now. Another suggestion of the mediæval behavior of the lake is found in the destruction of the so-called Dragon Town of Lung-shong, lying at some unidentified point southwest of Lop-Nor, perhaps at Merdeck. The

names "marsh" and "lake" are both used for Lop-Nor in the Chinese work where the history of the town is recorded. According to Himly's translation, "Lop-Nor streamed over its banks, and laid waste the land; the foundations of the city still exist. In the time of Chi-ta [1308–1311 A. D.] the overflowing water, which in the morning reached the west gate, and in the evening the east gate, was driven by the wind into the form of a dragon." Apparently, the level of the lake rose so as to overwhelm the city completely. It is impossible to determine whether the rise was temporary like that of 1900, or permanent. The Lopliks do not appear to have come to Lop-Nor till some centuries after the destruction of the Dragon Town. When they came, the lake still appears to have been larger than now. A familiar tradition relates that in the days of their ancestors, two or three centuries ago, the lake and the Tarim River were larger than to-day. One of the most intelligent among them said to me: "The water grew less, and that made the fish die. Then our fathers could not get enough to eat, and they began to die or move away."

More trustworthy evidence of the recent greater size of the lake is found in six little strands discovered by Hedin in his survey of the old lake-bed. They lie below the main twelve-foot strand, and appear to correspond closely to the lower set of old beaches at Lake Pangong. They are marked by rows of tamarisk bushes, mostly small, showing that the strands were temporary, and also by sand and limnea shells. On the older strands the bushes are for the most part dead, while on the younger many are living. There is no other vegetation in the vicinity. The fact that even on the oldest

strands the dead bushes have not yet been blown away by the wind shows that the time when the lake stood here cannot be very remote; and the living bushes probably indicate a period only a century or two ago. Hedin does not state the height of the strands above the lake, but according to his section of the old lake-bed, the upper lies six feet above the highest recent level of Kara Koshun, that of 1901. "In the history of Kara Koshun," Hedin says, the strands "serve as milestones marking successive stages on its way to destruction. The first . . . proves that the northern shore of the lake once extended 12 km. [seven and a half miles] farther to the north than it now does, and implies that its area was at least twice as great as it now is. On the whole . . . the lake has shrunk at a pretty regular rate." Hedin does not believe, however, that the climate of the Lop basin has changed. He attributes the shrinking of the lake to the assumed increase in the size of the marginal lakes of the Tarim, but my observations show that the marginal lakes, the river, and the lake of Lop-Nor all increase and decrease in size together.

Elsewhere Hedin gives what seems to be evidence that the lake stood still higher not many centuries ago. In the salt plain of the old lake-bed seventeen miles north of Kara Koshun and seven feet above it, he found, as he says, "a stake of tamarisk wood 35 cm. [ten inches] long, half buried in the ground, and undoubtedly placed there at a time when the locality was under water. The lower end of the stake was sharply pointed and burnt. Three of my attendants, who were Lopliks, thought that it had been used to moor canoes to, when their owners had been out on an exploring

expedition, and had been unable to reach dry land before nightfall. . . . This piece of wood furnished another proof that this part of the desert was once a lake-bottom, and that the lake was navigated by boats."

A more conclusive piece of evidence as to the former expansion of Lop-Nor is illustrated in the map accompanying this volume. On hearing that the road from Charklik to Tung Hwang along the south shore of ancient Lop-Nor crossed part of the salt-bed of the old lake, it naturally occurred to me that if the lake ever covered all of the salt plain during historic times, there might be an old road skirting the former shore-line. At Chindelik, near the middle of the old south shore, I hunted for such a road and found two. One follows the twelve-foot strand; while the other runs above the thirty-foot strand along the top of the bluffs which mark it, and from a quarter of a mile to a mile from them. The upper road traverses a plain of sand and gravel, and is marked at intervals by cairns of stones, one large, the others small. For two days I zigzagged between the two old roads, and at various points saw that they always bear the same relation to each other and to the bluffs and beaches marking the strands. The present road runs almost direct from Chindelik, where there are fairly good springs, to Sachgan Sai, the next source of water, where the springs are very saline. The distance is about twenty-four miles, a long day's journey for loaded oxen, donkeys, and camels, even though the track is level and easy. By way of the old road at the base of the cliffs above the twelve-foot strand, the distance between the same points is about thirty-two miles, too much for one day's journey, though the track is per-

fectly level and almost ideal in texture. By way of the higher old road, above the bluffs, the distance is a mile or more greater, and the track runs through heavy sand in some places, and up and down in crossing valleys in others. Along both of the ancient roads, as well as along the modern road, the country is absolute desert, with neither water, wood, nor forage from Chindelik to Sachgan Sai. It is scarcely probable that the old routes involving an extra day's journey would ever have been followed, if the shorter modern route had been practicable.

When I questioned Tokhta Akhun, our accurate and much-traveled Loplik guide, he told what he knew of the old roads: —

"Yes, I know about the road at the foot of the bluffs. When I was a boy, there was a little old man, a hundred years old, I think, and all bent up with age. He said that long ago when the lake was bigger than now, the Lopliks used to bring fish in canoes to Lachin, where canoes cannot now come. They loaded the fish on donkeys, and carried them to Tung Hwang to sell. Here at Chindelik, the old man said, the road made a big bend to the south which it does not now make. This road at the foot of the bluffs is the one. Why did they go that long way? I don't know. Perhaps the modern road was muddy. A few years ago [during the recent period of high water, it will be remembered], when I came this way, there was a place halfway from Chindelik to Sachgan Sai where there was bad mud for two or three hundred yards, and we had to help the donkeys."

"How about the other road, the one on top of the bluffs?" I asked.

"I never heard of it," was the answer; "but I know that one summer a half-witted man of our village [Abdal] tried to go across the gravel to Tung Hwang, and died of thirst. A Chinese amban and his servant, with a camel, came the same way from Tung Hwang one fall. The amban reached Charklik, but the servant died of thirst on reaching the salt spring at Dunglik. The Chinese know all old things. Perhaps the amban had read of this road. And I remember that my grandfather used to say that when he was a boy, a man named Osman Bai and his servants tried the same way across the gravel in summer, but got lost. The party scattered everywhere in search of water. One reached Lachin, and another Kurgan Sai, but Osman Bai and two or three others died."

Apparently, the present route has been in use only one or two hundred years. Previously, the lake was so high that the salt plain which the road now traverses was muddy, or perhaps under water. Every one was obliged to follow the circuitous dry route along the twelve-foot strand. Still earlier, this too was impracticable, seemingly because the water actually reached the strand, and little inlets cut across the course of the later road. Travelers necessarily used the still longer and harder route over the gravel and sand above the bluffs. Unfortunately, we have no means of dating the road, but probably it was used in mediæval times after the abandonment of the Lulan route.

The inferred history of Lop-Nor during the last two thousand years may now be summed up. We have first a comparatively large lake. It is said to have had a length of seventy-five miles each way, and this was in spite of the

large amount of water which must have been diverted from the Tarim River by the populous towns of Lulan and of more remote districts. Next, during the early centuries of the Christian era, there is a decrease in the recorded size of the lake, and this even though the towns of Lulan and other places were being abandoned and their water supply set free to reinforce the lake. Then, in the Middle Ages, there appears to have been an expansion of the lake. This can hardly have been due to diminished use of the rivers for irrigation, for at that time the population of the Lop basin appears to have been greater than now, though not equal to that of the Buddhist epoch of prosperity about a thousand years earlier. Finally, during the last few hundred years, there has been a decrease both in the size of the lake and in the population about it. Thus the fluctuations of Lop-Nor agree perfectly with the climatic pulsations of which we have found proof in other parts of the Lop basin and in Kashmir. Far to the west, at Ordam Pasha, Stein describes ruins for which no adequate water supply now exists. And far to the east, the united Bulundsir and Tan-Ho rivers appear once to have flowed to Lop-Nor. On the dry lower part of the course which they formerly followed, the natives describe two ruined sites of the type with which we are familiar. The Chinese of Dung Khan (Tung Hwang, or Sa-Chow), higher up on the Tan-Ho, say that the ruins were abandoned by their ancestors long ago because the water of the rivers would no longer reach them. In the same region, the old Chinese local history, translated by Mr. Hunter, says that certain mountains were formerly covered with snow all the year round, though now they are

free from it during the summer. Everywhere in the Lop basin tales of sand-buried cities still to be discovered haunt the desert. Throughout the entire fifteen hundred miles of longitude and four hundred of latitude of the Lop basin, the same great series of climatic pulsations appears to have occurred.

NOTE. — Since this book was written, in 1907, the explorations of Stein have shown that Lulan was probably near Cherchen on the south side of the Lop basin. This changes part of the argument of this chapter but by no means destroys its validity. It merely means that as yet we have no historic accounts of the place that I have called Lulan on the basis of the earlier statements of Stein and Hedin.

CHAPTER XV

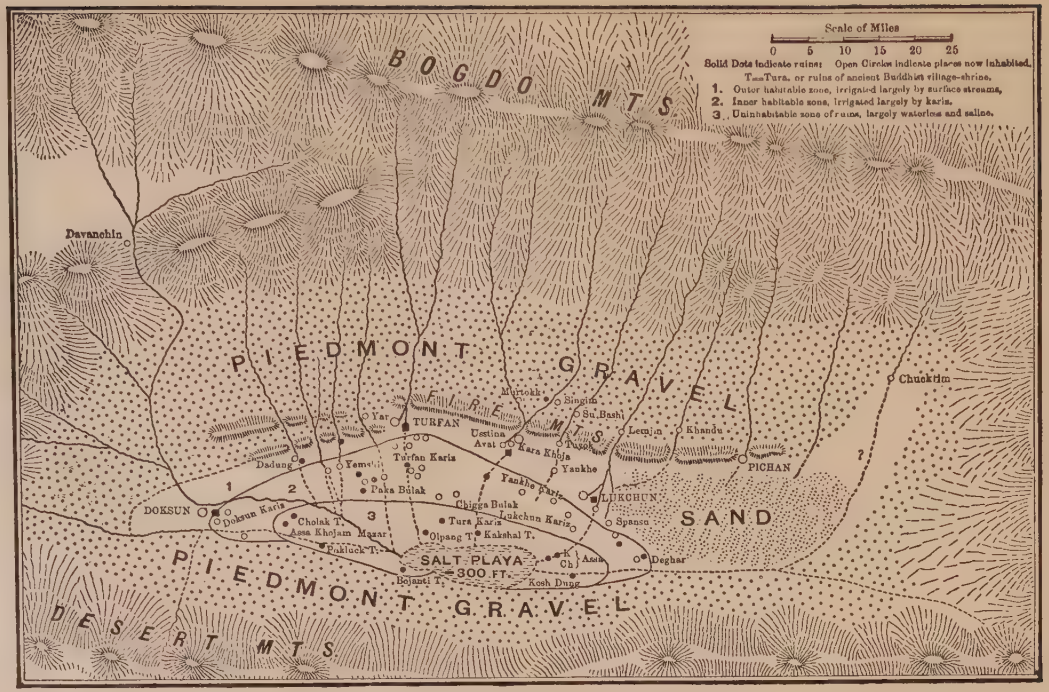
THE DEPRESSION OF TURFAN

ON February 23, 1906, after nearly nine months in the basin of Lop, I crossed the Desert Mountains (Chol Tagh) and entered the basin of Turfan. Though the physical features of the two basins are almost identical, and though the same race inhabits both, I felt at once a subtle difference in both scenery and people. In the Lop basin all had been vast, hazy, and uninspiring. Though the mountain range to the south affords some of the most magnificent scenery in the world, one may live near it for months and scarcely see it by reason of the haze. The country had yielded me some of its choicest secrets, but I felt no affection for it, no longing to return. Turfan is scarcely more attractive in outward appearance, but it is small enough to be comprehended at a glance. It possesses the qualities of the life-sized representation, as opposed to the colossal. The basin floor extends scarcely one hundred miles east and west by fifty north and south; the area is only about two per cent of that of its gigantic neighbor. From the west shore of the evanescent terminal salt lake of Böjanti, in the bottom of the basin three hundred feet below sea-level, one can see at a glance all the features which, in the Lop basin, can become familiar only after months of travel: the ring of encircling mountains; the concentric zones; the dwindling, withering rivers, flowing from terraced valleys out upon the plain toward the inconstant lake which most of them strive in vain

to reach; the zone of piedmont gravel; the gently sloping plain of the basin floor covered in part with dry brown reeds and pale green camel-thorn also dry, and in part a mere waste of naked clay or hard, white salt; the aggregation of huge, sombre sand dunes five or six hundred feet high, rising like a range of mountains, dark gray and deep purple, far beyond the shimmering white expanse of ice and salt which forms the playa of Böjanti; the villages set in dark patches of irrigated land; and the ruined towns and dead vegetation giving evidence of a former more abundant water supply.

Apart from the questions of size and altitude, it is chiefly the dearth of vegetation which differentiates the Turfan basin from that of Lop. In the larger basin, in spite of vast deserts and areas of dying vegetation, the villages are usually located in the midst of vigorous reeds, tamarisks, and poplars, supported by the great floods of early summer. One's mental picture of a village includes hundreds of trees for every house. In Turfan, on the other hand, wild trees are unknown, having long been cut off, if they ever existed, and even cultivated trees are scarce. One thinks of a Turfan village as a group of gray mud houses, and only secondarily does one call to mind the precious trees — brown and bare when I saw them — which rise behind the protection of high mud walls. A glance at the horizon shows the reason for the difference — the mountains rarely rise to the limit of perpetual snow. Hence the time of highest water comes in the early spring, and there is no unfailing surplus in summer.

In the Lop basin, the summer floods from the snowy



MAP OF THE BASIN OF TURFAN

Kwen Lun range, and from the high Tian Shan plateau and the Pamirs, make life easy and care-free, and the people are mild and open-handed. In the Turfan basin, on the contrary, the struggle for life is more relentless; the farmer must search for every drop of water above ground and below. And so, as it seemed to me during my too brief stay of twenty days, the mildness of the Chanto immigrants from the Lop basin who have peopled Turfan has changed to stolidity; and their open-handed hospitality to grudging calculation of the chances of profit. The people are not rude, nor inhospitable; but because life is hard, they are careful as to how they waste their time and substance. It seemed to me, too, — though my own prepossession may have been father to the thought, — that in their indifference, their addiction to drugs, their more degrading vices, and perhaps in other ways, the people of Turfan have become slightly differentiated from their cousins in the Lop basin, and have become more like the Persians. Possibly the change is due to contact with the Chinese, and not, as I am inclined to believe, to physical circumstances.

However it may be as to the people, there can be no question as to the Persian character of the scenery. At Doksun, or "Ninety," the first town which we reached in Turfan, I found the days so warm at the end of February that the most pleasant place to sit at noon was on the flat mud roof. As I looked abroad over an ornamental parapet of sun-dried brick, a dreamy haze softened, but did not blur, the rounded outlines of the pale blue Desert Mountains to the south. Far to the north and west the snowy tops of higher peaks, rising 12,000 or 14,000 feet, gleamed fitfully

among wisps of cloud. At their foot, broad, naked slopes of gravel were broken by descending lines of little mounds, the heaps of earth around the mouths of the wells by which the "kariz," or underground canals are entered and cleaned. Nearer at hand, the adobe walls of ruined forts or Buddhist shrines stood white and clear in the bright sunshine; while around them stretched a smooth yellow plain, where the reeds were all dead and broken off even with the ground. Nearest of all, four or five Chantos in sober snuff-colored gowns, and two women in picturesque red jackets worn over blue skirts reaching to the knee, were spreading manure on gray fields. Two men plowed it under with wooden ox-plows like those used from time immemorial all over Asia. A Chinese merchant, clad in pale blue, walked across the field toward the walled enclosure of the Chinese town; a high covered cart set on a long axle between two big cogged wheels lumbered by with one horse in the shafts and three abreast in front, and as it creaked between the high mud walls protecting precious orchards, the lolling driver encouraged his team with shouts of "Owa, owa, owa, *Oh!*" and a wave of his fish-pole whip. Suddenly, not only the distant scene, but the pale gray, almost dazzling prospect of neighboring walls and fields, was swallowed up in dust. A strong northwest wind had sprung up. Soon it increased to a gale, and I had to leave the roof to dust and pattering sand and two merrily rolling gourds. By sitting low on the warm mud oven filling half my room, I could have procured light enough for my work, if the room had not been darkened by the heads behind the dozen or twenty Dungan eyes glued to holes torn or sucked in the paper windows.

That evening, as my host was entertaining me by playing on a marvelously slender and long-necked mandolin, he remarked: —

"This wind is nothing. You just wait."

Two days later, we were camped in the reedy salt plain twenty miles to the east beside a white wall made of blocks of rock-salt. An evening gale came up, and blew over my tent and that of the men.

"This is nothing," said the host, who had become our guide. "Just wait till April or May. Then the wind takes the roofs off houses, and leaves the young wheat with two or three inches of its roots swept bare of earth. All this wind comes from a little lake on the way to Urumchi. There is an iron gate in the lake, and it is only half shut. If any one could shut it, the wind would stop."

I visited the lake on the way to Urumchi. Two monoliths, about seven feet high, stand near the shore. Near them there are a number of artificial mounds of various sizes, and several lines composed of groups of stones. Each group consisted originally of about eight boulders from one to three feet in diameter arranged in a circle perhaps six feet across. The whole aspect of these relics of an unknown race is almost identical with that of certain mounds and stones which I saw in 1903 with Professor Davis at Son Kul and Issik Kul, six hundred miles to the west.

The climate of Turfan is characterized by extremes in other respects, as well as in its winds. On March 5, a quiet, sunny day, the temperature was two degrees below zero, Fahrenheit, at sunrise, but rose to fifty-four degrees above zero at noon in the shade of a high cliff. The summer in

this mid-continental basin of which the floor is below sea-level is of necessity very hot. Horses, cows, sheep, and camels die unless driven to the mountains. Only the hardy donkey can live through many seasons. In 1894, when a Russian expedition spent the year at Lukchun on the east side of the basin, the mean temperature of June and August was eighty-seven degrees Fahrenheit, and of July ninety-one, and the absolute maximum one hundred and eighteen. The year was not considered especially warm.

Such temperatures as those of Turfan render exertion of every kind almost impossible in summer; but they make the fruits of the region most luscious. At the beginning of March, I found in the markets fresh melons, grapes, apples, and pears, all of them most delicious and perfectly preserved. The only exception was a kind of pear which is never sold until it is rotted, as the flavor is then supposed to be best. In summer the variety of fruits is of course greater. The heat is so intense that melons are cut into strips and dried in the sun. In most parts of the world they would rot long before they became dry.

According to the Chinese, the summer is so hot that during the day the birds all gather in the shade of the trees beside the rivers. If one of them flies up, he is scorched to a cinder, and falls sizzling into the water. Another Chinese yarn affirms that the heat is so great that after blowing on your rice to cool it, you must ply your chopsticks as fast as possible. If you do not, the rice will become hot again and burn you.

In winter, as might be expected, Turfan is cold. The mean temperature in January, 1894, was fifteen degrees,

and the minimum minus five, which is probably unusually high, since I found a temperature of minus two in March. Snow never falls: at least, my host at Doksun said that during the forty years of his life he had never seen any there, although it falls yearly on the mountains round about. Rain, he added, is almost equally rare. Once or twice each summer it falls in sufficient quantity to wet the ground, though not to run. Once in ten years or so, there is a cloudburst, and raging floods ruin fields and houses.

In order to see as much of Turfan as possible in a short time, I undertook to go around the periphery of the basin with the horses, sending the camels to the capital, also called Turfan, to be sold. It proved impossible to go south of the lake because there is no water, but north of it there was so much water that three horses once became almost inextricably stuck in the mud, and we were forced to follow a very crooked route. At Deghar, the most eastern village of Turfan, we found a queer anomaly. Although the village lies in an almost rainless region at the foot of some of the highest sand dunes in the world, it not only has suffered from occasional floods, but the houses have to be rebuilt every five years because they sink into the mud. The plain of Turfan is so flat that in spring underground water from the mountains converts hundreds of square miles into impassable muck. It might be expected that plants would grow abundantly, as in the zone of vegetation of the Lop basin. So they do, to a certain extent, and have done much more extensively in the past. On the whole, however, the water dries up so early in the season that only camel-thorn and a few reeds can flourish.

I had supposed that in Turfan I should be free from the attentions of officials. It was disappointing, when we were camped far out in the desert, to have some horsemen bring presents of fruit, eggs, milk, ducks, sheep, raisins, dried melon, and little peanuts, the last considered a great delicacy, recently introduced by the Chinese. I did not object to the presents, but it was a nuisance to have to be encumbered with four or five men who had been ordered to search out the stranger in the remotest desert and provide him with all the needed and un-needed comforts of life until they brought him safe to the halls of the officials. At Lukchun, the most prosperous town of Turfan, I dined with the "Wang," or "Tributary King," who with two hundred retainers lives in a colossal cube of mud. He goes up to Pekin once in six years to "bow the head to the Grand Khan," as he put it. The Wang was a bright, attractive boy of seventeen, and we had much conversation in his native tongue, Turki. Though he rules but ten thousand people, he exacts absolute and unquestioning obedience with the air of one absolutely convinced of the divine right of kings. He grew confidential during our various talks, and told me how the local Chinese officials were jealous of his hereditary rights in so rich a region. He sometimes wakes at night, so he said, with a nightmare of the grim provincial treasurer, the Fan-tai, clutching at his throat. He proudly asked my opinion about the merits of his twenty rifles, with which, I judge, he vaguely hopes to be a match for the Chinese.

North of Lukchun I ascended a magnificent red canyon in a little range of mountains at the base of the main northern range, and later came down another of the same sort. A

rushing brook plunged over naked red rock between high terraces of silt and gravel. The wildness of the scenery set my Ladakhis to talking of their far-away gorges in the lofty Himalayas. When we came upon the huge ancient monastery of Tuyok, built largely in caves dug in the terraces, we felt as if we had been suddenly transported to Ladakh. The village of Tuyok itself, on the terraces at the mouth of the canyon, might well have been in the Indus valley. Turfan is crowded with the ruins of Buddhist temples and lamaseries. Each of the ancient holy places has retained its character in spite of the change from Buddhism to Mohammedanism, and the shrines of the past are the shrines of to-day The chief of them is here at Tuyok. The head sheikh entertained me in his own house. With the freedom from fanaticism characteristic of the Chantos, he took me into the inner shrine, where ordinary pilgrims are not permitted to enter. I fear it was a case of the power of the purse. He thought I was rich because I could afford to spend three or four dollars a day. When the Sheikh first heard of my approach, he sent a hasty messenger to recall his mother, who had started that morning for Lukchun to attend the wedding of the boy Wang. I remonstrated on hearing of this, but the sheikh answered: —

"If the Wang should see her at the wedding and know that she had left great guests at home uncared for, he would be very angry. He sent a special message that we were to show the Sahib every honor."

Etiquette obliged the sheikh's wife to mortify her curiosity, and hide her face and run away whenever she saw me; but his mother, simply because she was his mother, could

not only speak to me, but could bring meals to my room, though her son must set them before me.

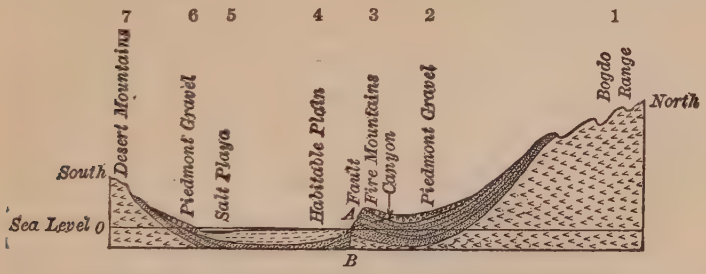
Tuyok is a peculiar town. All of its two hundred and fifty families live by grape culture. They say that they raise absolutely nothing else except a little fruit and a few vegetables for their own consumption. Their grapes, a small, seedless, green variety, are taken to Pekin for the emperor's table. They are decidedly the best that I have ever tasted.

On leaving Tuyok, I visited various ruins, especially those of Kara-Khoja, the ancient capital; and finally finished my explorations in Central Asia at the city of Turfan, March 12. There I met the Rev. G. W. Hunter of the China Inland Mission, and had the keen pleasure of talking English for the first time in six months. He, too, had been long alone among natives. More than once Chinese words slipped unconsciously into his conversation, as Turki did into mine. From Turfan I rode a four days' journey to Urumchi, the provincial capital. There the Chinese viceroy, and still more the Russian consul-general, Mr. Dolbejef, assisted me most heartily. As my work was now finished, I disposed of my horses, and sent back my faithful servants by the main caravan road through Kucha to Khotan, where three of them went east to their homes near Chira and Keriya, and two traversed the Karakorum route to Ladakh. I parted from them with genuine regret, for one and all had done most faithful and efficient service. For myself, I hired a two-wheeled Chinese cart and two worthless servants from Turfan. Seventeen days of hard traveling to the northwest across Dzungaria brought me to Chuguchak on the border of Siberia, April 7. There the Russian consul,

Mr. Sokovu, did everything possible to facilitate my journey. I cannot speak too gratefully of the great courtesy with which I was everywhere treated by Russian officials. Eight days of rough riding in a post-wagon brought me to Omsk on the Irtysh River. There, with a crowd of friendly officers returning from the Japanese war, I took the train for Moscow, where I arrived the 24th of April, 1906.

To resume the description of Turfan, the chief physical features of the basin will be readily understood from an examination of the accompanying map and cross-section, (page 307). On the north, the dark Bogdo range, numbered 1 in the cut, the northeastern end of the Tian Shan plateau, rises to a height of from 12,000 to 14,000 feet, and forms the source of the chief streams. Its base is buried in a typical piedmont deposit of sloping gravel (2), like a beach ten or fifteen miles wide, in which practically all the streams from the mountains disappear except in time of flood. If the gravel, as followed from the mountains toward the playa, merged into the finer deposits of the basin floor as it does in the Lop basin, most of the water would never reappear, except perhaps in the form of a zone of vegetation, and Turfan would be almost uninhabitable. Fortunately for man, a geological fault or dislocation, A–B in the section, has taken place in the basin during very recent times along a line running roughly east and west parallel to the Bogdo range, and about thirty miles south of its crest. On the north side of the fault, a part of the earth's crust has been pushed up, and forms a little range (3) with a southward facing scarp of bright red sandstone. The redness of the range has given rise to the name "Fire Mountains"

among the Chinese, and hence has come the erroneous assertion that there is an active volcano in Central Asia. The hollow between the Fire Mountains and the Bogdo range is so deeply filled with gravel that the little fault-range appears very insignificant on the north side, though on the south it rises in a steep, straight escarpment to a height of nearly two thousand feet above the lacustrine plain (4) at its base. While the Fire Mountains were being uplifted, the streams from the Bogdo range cut gashes across it, the narrow red canyons mentioned above, which penetrate



GEOLOGICAL CROSS-SECTION OF THE TURFAN BASIN

into the very heart of the northern piedmont gravels, and drain the hollow between the ranges. Most of the water which seems to have been lost at the base of the high range drains out again into the canyons, and after dashing down the steep red gorges, emerges on the lake plain to support numerous prosperous villages. Farther south and on either side of the streams from the canyons, no surface water is available for irrigation, and the people have adopted the Persian device of digging "kariz," underground tunnels with a grade less than that of the sloping plain, and thus lying farther and farther below the surface as they are fol-

lowed up from the mouth. South of the row of villages supported by kariz the gently descending plain becomes saline and marshy. Finally, it merges into the shallow central lake, or playa of Böjanti (5), which is dry except in winter, when the water which reaches it freezes and will not readily evaporate. South of the lake, another lifeless gravel plain (6) rises high on the side of the slaty, rounded mountains of Chol Tagh (7). At the western end of the basin, numerous streams unite to form a centripetal river analogous to the much larger Tarim of the Lop basin. This succeeds in reaching the lake during the winter, though diverted for irrigation in summer. A group of centripetal streams from the northeast side of the basin might also reach the lake, if they were not lost in the Kum Tagh, or Sand Mountains, huge heaps of dark, heavy sand, which have been piled up by the fierce west and northwest winds of spring to a height of four, five, and even six hundred feet, with steep, unbroken slopes from top to bottom.

In general, the scenery of the Turfan basin is uninteresting. The lake is a mere mucky salt swamp; the plain, except where there are villages, is a monotonous expanse of reedy stubble and clay with a little camel-thorn: the gravel slopes are dreary wastes of barrenness: the Sand Mountains, though striking, are peculiarly sombre by reason of the dark gray and deep purple shades of the long slopes. They lack the delicate details so beautiful in sand deposits of lighter weight and color. The Desert Mountains (Chol Tagh) on the south are so flat-topped and subdued in general outline that one gladly turns from them: even the high Bogdo range on the north arouses enthusiasm only when

one approaches it much more closely than the ordinary traveler or inhabitant of Turfan is likely to do. One feature alone, the little red range along the fault-line, redeems Turfan from being utterly commonplace and almost uninhabitable.

Evidences of changes of climate in Turfan are as abundant as in the Lop basin. Everywhere one encounters vast beds of dead reeds, not only in regions where the digging of kariz has lowered the water-level, but even in places where the activities of man might be supposed to tend to increase the amount of water locally. Grum-Grshimailo, a Russian explorer, who visited Turfan in 1889, says that though now the playa of Böjanti is dry most of the year, Chinese records and an old song seem to indicate that formerly there was at least a large reed-swamp, if not a lake. From this and from the evidence of ruins he concludes that the water supply has greatly diminished. The plain is dotted with ruins not only in districts which are now inhabited, but in more remote regions, where no surface water is now available and the underground supply is saline. Ten such places (Assa Bulak, Pokluck, Cholak, Böjanti, Kakshal, Olpang, Tura Kariz, Chong Assa, Kichik Assa, and Kosh-Dung) appear on the map on page 297, and I heard of still others. In some cases the only relics of human occupation are adobe "turas," as Buddhist stupas are called in this region, and a few bits of pottery. Elsewhere, as at Cholak, Chong Assa, and Kichik Assa, there are ruins of forts, houses, and lamaseries. The stupas appear to indicate the sites of villages, for they are on the prolongations of watercourses in places where agriculture would

be possible if the streams were of greater size. The forts mark the sites of larger villages or towns, located, like the villages, on watercourses where the water is insufficient or saline.

In addition to the ruins located in places where no water supply is now available, there are many in places where practically the whole of the present supply comes from kariz. Grum-Grshimailo suggests that the great density of the population in former times may have been due to the greater number of kariz in those days. During my stay in Turfan, I visited all the chief towns, and made careful inquiries as to the total population, the proportion of the total supported by kariz, the origin of kariz, and the location and age of abandoned kariz.

My most intelligent informants, the Beg of Lukchun and a learned mullah of the same place, both said that the kariz was introduced from Persia or Transcaspia about 1780 A. D., in the days of the Wangs Skender (Alexander) and Yunus (Jonah) of Lukchun, and Suliman (Solomon), who built the great brick tower at Turfan. Previously the people relied on surface water and wells. When I asked if there were no traces of abandoned kariz, they said:—

"No, none except those whose history is known. Among the ruins there are many old wells, half filled with rubbish, but no one has ever found any trace of a kariz. There are some old ones which are now dry, but they were all dug since 1780 or thereabouts. At Assa, about fifteen [two of which I saw] were dug sixty years ago [about 1845], but the water proved so saline that the diggers gave them up without even building houses. Most kariz water is a little salt

and spoils the fields in a few years, unless they are heavily manured."

It seems safe to conclude that the kariz is, comparatively speaking, an innovation in Turfan, and that the greater density of population in ancient times was not made possible by its more general use. On the contrary, under its stimulus there has been a marked increase in population during the last century, as I was told again and again. As nearly as I could ascertain, the population of the entire Turfan basin consists of 9500 families, about 50,000 souls. Of these, 5400 are supported by surface water, and 4100 by kariz water. If it were not for the kariz, the population of Turfan would be only sixty per cent as great as at present, and would not number more than 30,000. Only the towns close to the Fire Mountains and at the east and west ends of the basin would be habitable. There would be nothing to represent the numerous ancient towns, which, though they had only surface water to rely upon, once dotted not only the region of the kariz villages, but also the still drier, more saline region farther toward the playa.

The history of Turfan, so far as it is known, is precisely what one would expect if it has passed through the same series of climatic changes as has the Lop basin. At the beginning of the Christian era, Turfan is mentioned in Chinese records as a densely populated and most flourishing region. During the succeeding dry epoch, it sank to insignificance; but when the climate changed for the better, it revived. According to Grum-Grshimailo, Kara-Khoja, the largest of the ruined towns, was founded between 874 and 913 A. D., and existed until 1644 A. D. or later. In its days, Turfan was

renowned for its library, its art, and its craft, as well as its might in war. Lecoq, in the course of archæological investigations of which the results have recently been published, found manuscripts on paper, leather, and wood, in ten different languages. Most of the manuscripts date from the early days of Kara-Khoja. An examination of the languages shows how, when favorable climatic conditions caused Turfan to become capable of supporting a dense population, people poured in from every quarter. Speakers of Nagari and of two dialects of Brahmi came from India on the southwest; Tibetans and Tanguts brought their language from the southeast; Chinese from the east; Uigurs and Turks from the northeast, north, and northwest; while from the west came people who were probably Nestorian Christians, and who brought the Syriac and Manicharean tongues and an unknown language allied to Syriac. The presence of Tibetan manuscripts in Turfan is especially interesting because at the end of the eighth century there was a great incursion of Tibetans into Chinese Turkestan. The underlying cause of this is not known with certainty; but apparently, during the preceding dry, warm epoch, Tibet had become relatively habitable, while now, when the climate became colder, the Tibetans found difficulty in raising crops or in maintaining flocks upon their high plateau, and so sought new homes.

The mediæval period of dense population and great prosperity in Turfan was followed by a time of almost complete depopulation two centuries, more or less, ago. This too appears to have been closely related to a change of climate, for at this time Central Asia was apparently growing more

arid. This does not mean that the climate two hundred years ago was drier than now, — it may have been moister, — but at this time the *change* from the moister conditions of mediæval times to the drier conditions of the present produced its maximum effect. The direct cause of the disappearance of the people from the villages of Turfan was the raids of plundering Mongol nomads from the surrounding mountains. To-day there are no Mongols in the mountains. The country is too dry. The nearest are at Kara-Sher, a hundred and fifty miles away. In mediæval times, however, when there was more moisture and vegetation, the mountains appear to have afforded homes to bands of Mongol nomads. So long as they prospered, they lived, apparently, on terms of comparative peace with their neighbors in the plain. When the change from the mediæval climate to that of to-day began to take place, the nomads must have been the first to feel the pinch. Life, we may suppose, became hard as their cattle and flocks began to dwindle, and the bold mountaineers began to plunder their weaker neighbors in the villages. The plain gradually lost a large part of its settled inhabitants, and there was no chance for it to recover while the Mongols remained. The Mongols more than almost any other race despise agriculture. Therefore, though they occupied the plain, they did not cultivate it. They still presumably migrated from the plain to the mountains in summer: and ceased to do so only when the mountains became so dry as to be useless for flocks. Then they migrated farther, perhaps dispossessing some other tribe; and Turfan was left open once more to settlement by Chanto immigrants from the Lop basin. The depopulation was

merely an episode accompanying the reduction of the mountains to a state where they were too dry to be inhabited by nomads. As an historic incident, it is scarcely worth recording; but it appears to typify events which have taken place on a scale involving continents. During the last century and a half, the absence of enemies in the mountains and the new means of controlling nature which the Turfanliks have found in the kariz have allowed the population to increase in spite of unfavorable climatic conditions.

CHAPTER XVI

THE ANCIENT CLIMATE OF IRAN

IN order to appreciate fully the great historic significance of the changes of climate of which we have found so abundant evidence in Chinese Turkestan, we must now endeavor to ascertain over how wide an area the changes have extended. Two regions, Iran and the Caspian basin, which I studied in 1903–04 as a member of the Pumpelly Expedition, shed much light on the subject, because, being arid and containing lakes without outlets, changes of climate produce effects more marked than those produced in moister regions where the lakes all have outlets. Iran is a convenient term for the great region of basins and mountains covering Persia, Afghanistan, and Baluchistan. In the first volume of "Explorations in Turkestan," I have described the extremely arid condition of Iran to-day, and have set forth various reasons for believing that climatic conditions have not always been the same. Accordingly, I shall here consider merely a few of the chief lines of evidence, in order to show how closely the phenomena of Iran agree with those of the Lop and Turfan basins from one thousand to two thousand miles farther east.

Observant travelers in the more arid parts of Iran have almost without exception been much impressed with the unmistakable evidences that a change of some sort has overwhelmed the country. Ruins are incredibly numerous. Mighty cities of the dead crowd such places as Seyistan, the

province of Kirman, the piedmont region of Afghanistan, and the northern border of the great desert of Dasht-i-Lut. Those who have followed the track of Alexander declare that to-day it would be utterly impossible to travel as the conqueror did with a huge army in regions where now a small caravan of twenty or thirty camels can scarcely find water and forage. To be specific, when Alexander returned from India, he divided his army of 110,000 men into two parts, one of which, including the elephants, the invalids, and the heavy baggage, was put under the command of Krateros, and followed a route through Afghanistan and Seyistan. Alexander himself, as Sykes puts it, "faced the horrors of the desert by the route along the coast of Baluchistan, in order to supply his fleet by means of his army;" although Arrian says it was because of his wish to rival the journeys of Semiramis and Cyrus along the same road to India.

The route which Alexander followed is exceedingly difficult, even for a small and quickly moving caravan; and for an army such as that of the Greeks, which is stated to have been accompanied by women and children, the hardship must have been incredible. St. John is of the opinion that "in the early part of his march through Baluchistan, Alexander . . . must have been deceived by his guides, who seem to have kept him at exactly that distance from the coast where there is least water." Farther west, in southeastern Persia, conditions were scarcely better. Sykes, the latest and best authority on the region, speaks of it as follows: "During my journey from Chahbar to Ceh, in October, 1893, which was also the time that the Greek army traversed

Makran [southeastern Persia and southwestern Baluchistan], the temperature in the shade was generally about 100 degrees, while water was almost nonexistent, and what little there was we could scarcely drink [because it was so saline]." In speaking of the whole journey from Chahbar to Kirman during the months from October, 1893, to June, 1894, Sykes says: "Throughout the journey forage was our chief anxiety [although the caravan numbered only from a dozen to twenty men, with a corresponding number of horses]." Among the higher mountains of this corner of Persia, water can usually be found by digging in the dry watercourses, although it is very poor and scarce. Forage, however, is always hard to obtain, and the governors-general of the province almost never visit the district because of the scarcity of supplies. Yet Alexander must have crossed it with a large army. Northeast of Bampur, even in March, when vegetation is at its best, forage was so scarce that the governor-general, whose official guest Sykes was, had had a supply stored at every stage. The "desert stretch of more than 150 miles" along the north side of the Jaz Morian salt swamp, according to Sykes's account, was once thickly populated, as is shown by numerous ruins, and by the remnants of kariz, to the reported number of two hundred, which are now dry. Many of the kariz have probably been abandoned because of wars, but that does not explain how Alexander procured water for an army where there are now merely salt pools: nor how he procured forage for all his baggage animals where to-day a few score can barely subsist.

The division of Alexander's army which marched through Afghanistan under Krateros appears to have had no special

difficulties. Arrian, the historian of the expedition, merely remarks that "when Alexander arrived in Kirman, Krateros joined him, bringing the rest of the army and the elephants." Apparently, Krateros went via Quetta to Kandahar, whence his route is agreed to have been down the Helmund to Seyistan. So far the line of march would present no insuperable difficulties even to-day; though Bellew, who followed the same route, relates that where the road made a détour to get around an impassable portion of the river valley, some of his men nearly died of thirst on the hot gravel plain. Beyond Seyistan, Krateros's route must have led across the southern end of the desert of Dasht-i-Lut to Narmashir. As St. John says: "It would certainly puzzle a Krateros nowadays to march his elephants and heavy baggage from the Helmund to Narmashir; but there is every reason to suppose that part of Persia to have been far better populated and better watered than it is at present." The greater part of the distance of one hundred and eighty miles from the borders of Seyistan to Narmashir is the most absolute desert, either waterless, or supplied only with the most brackish wells.

Nasratabad, the one village, could scarcely furnish supplies for a hundred men, and everything for an army would have to be brought from Seyistan. Yet the route was once so important that strong fortifications, caravanserais, and other ancient ruins occur at frequent intervals, as do also kariz. Speaking of the eastern ninety miles of the route from Narmashir to Seyistan, Smith says that at both of the two possible stopping-places "water was obtainable by digging wells 5 feet deep, but it was brackish and bad; and at the latter place there is a stream so salt and bitter that

none of our animals would even touch it." Sykes describes the same route in equally uncomplimentary terms: —

"Gurz, the first stopping-place, is generally considered to be the worst stage in this part of the desert, the pools of water being quite undrinkable. . . . In summer, owing to the heat, Gurz is little better than a death-trap, and here, more than elsewhere, the abomination of desolation is realized. . . . At Shurgaz [the next stage] the water was just a little better, but so scanty that there was none for the camels." At the end of the third day, after marching over a hundred miles through the worst part of the desert, a better region was reached. "A day's halt was imperative, as our camels could hardly move." That a large army could cross such a desert is hardly credible; that such an army should have no hardships worthy of mention by the historian is less credible; and that they could bring elephants with them is least credible.

The elephants of Krateros are not the only ones mentioned in Persian history. Malcolm speaks of them as abundant in antiquity in the kingdom of Persia, as is shown both by the ancient records and by the sculpture of the country. Mazanderan, the rainy province immediately south of the Caspian, is the only part of the country that could now support them, but they are spoken of in other places.

Another interesting commentary on the climate of antiquity is afforded by a comparison of a description of the province of Kirman as it is to-day, by Sykes, and as it was in the past, by Strabo. The modern description runs: "The whole province can best be described as partly desert, pure and simple, and partly desert tempered by oases. . . . As

may be supposed, the rivers are unimportant." The ancient description is scarcely longer, but conveys a wholly different impression: "Kirman . . . lies more to the north than Gedrosia. This is indicated by its fertility, for it not only produces everything, but the trees are of large size. . . . It is also watered by rivers. . . . It includes also a desert tract which is contiguous to Parthia." Even since the twelfth century there has been deterioration, for in numerous cases ancient Mohammedan towns have been abandoned, and cannot be restored because no sufficient supply of water can be procured.

A single quotation, one from among many that might be given, will illustrate another kind of evidence on which many writers have based the conclusion of a change of climate in Iran. In speaking of the mountains of Kharan in the centre of northern Baluchistan, Vredenburg says: —

"In all the valleys around Zara there are to be seen hundreds of stone walls, which are called 'gor-band,' or 'dams of the infidels.' Sometimes they stretch right across the flat, pebbly floors of the great valleys, which, for want of a better name, are termed 'rivers.' They also occur across the entrance to most of the tributary ravines and at various heights above the main valley. The country is quite uninhabitable for want of water, and yet there is no doubt about the nature of these walls, which are similar to works erected to the present day in many regions of Baluchistan and Persia, being, in fact, nothing but terraced fields. In many cases they still hold back the soil, formerly cultivated, which had been heaped up against them. . . . The absence of any canals, the great height to which the walls are found up

the tributary ravines, show that the fields were not watered by means of some general scheme of irrigation with canals deriving their supply from some reservoirs placed at a greater altitude. Perennial springs, now everywhere dried up, must have existed in all the ravines where these remains are found, which shows how much greater the rainfall must have been formerly."

From the evidence of certain tombs, Vredenburg believes that the fields were in use during Mohammedan times. The original construction of the walls may date back much farther.

At Seyistan, near the place where Afghanistan and Baluchistan join Persia, I found that the shallow lake has passed through a series of fluctuations identical with those of Lop-Nor, which it closely resembles. The first stage in the lake's history, so far as man is concerned, was described to me by a village chief, who related the following legend found in his dearest treasure, an ancient book handed down from many generations of ancestors: —

"Long ago, in the days when my fathers worshiped the sun, all Seyistan was under water. A great lake covered the swamp and the villages, and even Zahidan and the ruins. One day King Solomon visited the lake, and saw that if the water were drained off, the bottom would be very good for grain and melons and all sorts of fruit. Wishing to benefit mankind, he sent for his 'Dhus,' huge giants with a single eye looking up from the tops of their heads, and told them to make the lake dry. They went to work faster than any man can understand. They dug up earth from this side and from that, and carried it on their shoulders and filled the

lake. By noon the work was finished. So the country is called 'Nim-ruz,' or 'Half-day.' When the work was done, the 'Dhus' went to the springs in the mountains and covered them, so that water no longer came out. Since that time there has been some water, but not so much as before."

Evidence that the lake once stood higher than now is found in two old strands fifteen and twenty-five feet above the present level. That the lake was once smaller than now is proved by a legend that the island of Kuh-i-Khoja was formerly part of the main land, and by the fact that the ruins of Sabari are described by the natives as lying in water ten or fifteen feet deep.

As to the later history of the lake, the owner of the book told me that when his ancestors came to Seyistan, about 900 A. D. according to the record, the region near the lake, where most of the villages now are, was again under water. The population was densely gathered around Zahidan and other more elevated places, where now the main ruins are found. It is not necessary here to enter into the details of evidence which I have set forth in "Explorations in Turkestan." Many, perhaps most, of the facts can of course be explained individually upon other theories than that of climatic change. No other theory explains *all* the facts. The most significant feature of the history of Seyistan is this: A comparison of physiographic, archæological, historical, and legendary data shows that all these lines of evidence agree in proving that the water supply of Seyistan has fluctuated during historic times. The fluctuations agree in time and character with the climatic pulsations of Chinese Turkestan.

Before passing to the Caspian Sea, we shall do well to con-

sider briefly the oft-repeated and generally accepted statement that the decay of Persia and of other semi-arid lands is due to wars and massacres and the frightful misgovernment which has prevailed for century after century. If a strong, just government were established, the former conditions of prosperity and dense population could be restored, so it is said. The progress which has been made under British rule in India and under Russian rule in Transcaspia shows what can be done. No one doubts that war and misgovernment are frightful curses which have again and again caused depopulation, nor is it open to question that the just rule of a European power might do much to restore the ancient prosperity of favored localities, and would be a blessing everywhere. That is not the point. The question is, first, whether the parts of the country which have suffered most from war and misgovernment are the parts which have become most extensively depopulated; and, second, whether, under present physical conditions, it would be possible for Iran to support a much larger population than that of to-day.

As to the relation of war and kindred disasters to depopulation and the decay of civilization, an examination of various Persian provinces shows that the former do not necessarily cause the latter.

The province of Astrabad on the southeast coast of the Caspian Sea is one of the few parts of Persia which is blessed with an abundant rainfall and great natural advantages. For centuries its inhabitants have been exposed to the terrible raids of the fierce Turkomans, and have also had the disadvantage of a very unhealthful climate. Their con-

dition, as described by Vambéry in the early sixties, was most pitiable. Even as late as 1880, when conditions had much improved, owing to the proximity of Russia, O'Donovan relates that murderous affrays were frequent even in the vicinity of Astrabad. Yet in almost the same paragraph the author enlarges on the density of the population, Persian villages of from twenty to thirty houses being scattered every five or six hundred yards. The fertility of the region is so great that people persisted in coming into it, in spite of the fact that their numbers were frequently decimated by the Turkomans.

Azerbaijan, the northwestern province of Persia, furnishes a more striking example of the same sort. This, according to Curzon, the best authority on Persia, "is the province which, excepting only Khorasan, has more often been violated by foreign invasion than any other part of Persia. . . . Its fertility of resources entitles it to be called the granary of northern Iran." Tabriz, the capital, "has fallen the first victim to invading armies, and has been successively held by Arabs, Seljuks, Ottomans, Persians, and Russians. What the rage of conquest has spared, nature has interfered to destroy. The city has been desolated by frequent and calamitous earthquakes. Twice we hear of its being leveled to the ground before, in 1392, it was sacked by Timur, whose path was strewn with ruins that vied with the convulsions of nature. Five times during the last two centuries has it again been laid low. A reliable historian tells us that 80,000 persons perished in the earthquake of 1721, and we hear from another source that half that number were claimed for the death-roll by its successor in 1780." Yet in spite of

wars and calamities, the fertility of the province is such that the city of Tabriz now numbers nearly two hundred thousand souls, and is the commercial metropolis of Persia, while the province contains two million inhabitants, and the population is four times as dense as that of Persia as a whole. Ruins are found in many parts of Azerbaijan, but they do not give the impression of a country whose population and resources have irrevocably declined, but rather of a country which has suffered and recovered. If war and calamity are the chief causes of depopulation and the fall of nations, it is remarkable that Tabriz has lasted so steadily, and that Azerbaijan is so prosperous and populous in comparison with the rest of Persia.

A comparison of the four provinces of Khorasan, Azerbaijan, Kirman, and Seyistan is instructive. Khorasan, as Curzon tells us in his exhaustive work on Persia, has suffered from war more severely than has any other province of Persia. Its northern portion, where the rainfall is heaviest, and where the greatest amount of fighting has taken place, is to-day one of the most prosperous portions of Persia. It contains numerous ruins, but they are by no means such impressive features as are those farther south. The southern and drier part of the province is full of ruins, and has suffered great depopulation. Azerbaijan, which, as we have seen, has suffered from war more than any province except Khorasan, is the most prosperous and thickly settled part of Persia. The relative abundance of its water supply renders its future hopeful. Seyistan has suffered from wars, but less severely than the two preceding provinces. Nevertheless, it has been depopulated to a far greater extent. Its

extreme aridity renders recovery well-nigh impossible, except along the Helmund. Kirman lies so remote behind its barriers of deserts and mountains that it has suffered from war much less than any of the three other provinces. Yet its ruined cities and its appearance of hopeless depopulation are almost as impressive as those of Seyistan. If war and misgovernment are the cause of the decay of Persia, it is remarkable that the two provinces which have suffered most from war and not less from misgovernment should now be the most prosperous and least depopulated; while the two which have suffered less from war and no more from misgovernment have been fearfully, and, it would seem, irreparably depopulated. It is also significant that the regions which have suffered the greatest ruin are those where water is least abundant, and where a decrease in the supply would most quickly be felt. War and misgovernment do not seem invariably to cause depopulation, nor has the process gone on most rapidly where war has been most prevalent.

It is often asserted that with proper irrigation methods Iran might support a population much larger than that of to-day, and the people are taken to task for not utilizing their resources. They do utilize them, however, and it is true of the Persians, as Holdich says of the Afghans, that they "have, from time immemorial, been great practical irrigation engineers. Every acre of rich soil is made to yield its abundance by means of every drop of water that can be extracted from overground or underground sources. It would be rash to say that the cultivable area of Afghanistan could be *largely* increased." Goldsmith, who knew Persia

from end to end, was of the same opinion in regard to that country, as he shows when he speaks of "the precariousness of cultivation, even where to many travelers fertility has appeared undeniable and of considerable extent."

The mistake of overestimating the possibilities of Iran is very common among travelers. For example, O'Donovan describes the country between Abbasabad and Mazinan, a few miles west of Sabzawar, on the road from Meshed to Teheran, as "a dreary flat, entirely uncultivated, though plentifully supplied with water from the Kal Mura River, which has left marks of extensive inundations in numerous white deposits of salt. This plain would undoubtedly produce abundant crops of rice, if properly cultivated." After passing numerous ruins of fortifications, reservoirs, tanks, and other structures, O'Donovan "crossed the Kal Mura, a river about forty yards wide here and tolerably deep, though on the maps it is usually marked as dry in summer. The country around was once extensively cultivated, as the traces of irrigating ditches show. . . . Nowadays, cultivation is only attempted immediately around the towns, and even there . . . the crops are miserably poor." In June, 1880, when O'Donovan passed this way, the Kal Mura River must have been phenomenally high, for when Smith traversed the region in May, 1872, a year of fair rainfall, with good crops, he found the Kal Mura at the same place "a narrow rivulet of salt water." O'Donovan does not appear to have thought of connecting the "miserably poor crops" with the "numerous white deposits of salt." Apparently, it was salinity and lack of water, not lack of energy, which prevented the Persians from raising "abundant crops of rice."

A year previous to Smith's journey, this region suffered from a famine of such frightful severity that he found skeletons of men along the road where they had died of hunger, skulls of children in the very houses, four hundred and fifty out of the six hundred shops in Nishapur closed, and others barely able to subsist. Sebzawar was reduced from a population of thirty thousand to scarcely ten thousand. Everywhere death ran riot, and frequently half the people of a village perished. The famine extended with great severity over all Persia except the northwest. For six years the rainfall was scanty, and there was much suffering. Then came a season when the crops in many places failed utterly for lack of water, and thousands of people perished in every province. In view of the periodic return of such famines, it does not seem probable that Iran is capable of supporting permanently a population much in excess of that of to-day. A diminishing supply of water appears to be the cause of the poverty, distress, and discontent of Persia, and these in turn have been potent causes of war and misgovernment.

CHAPTER XVII

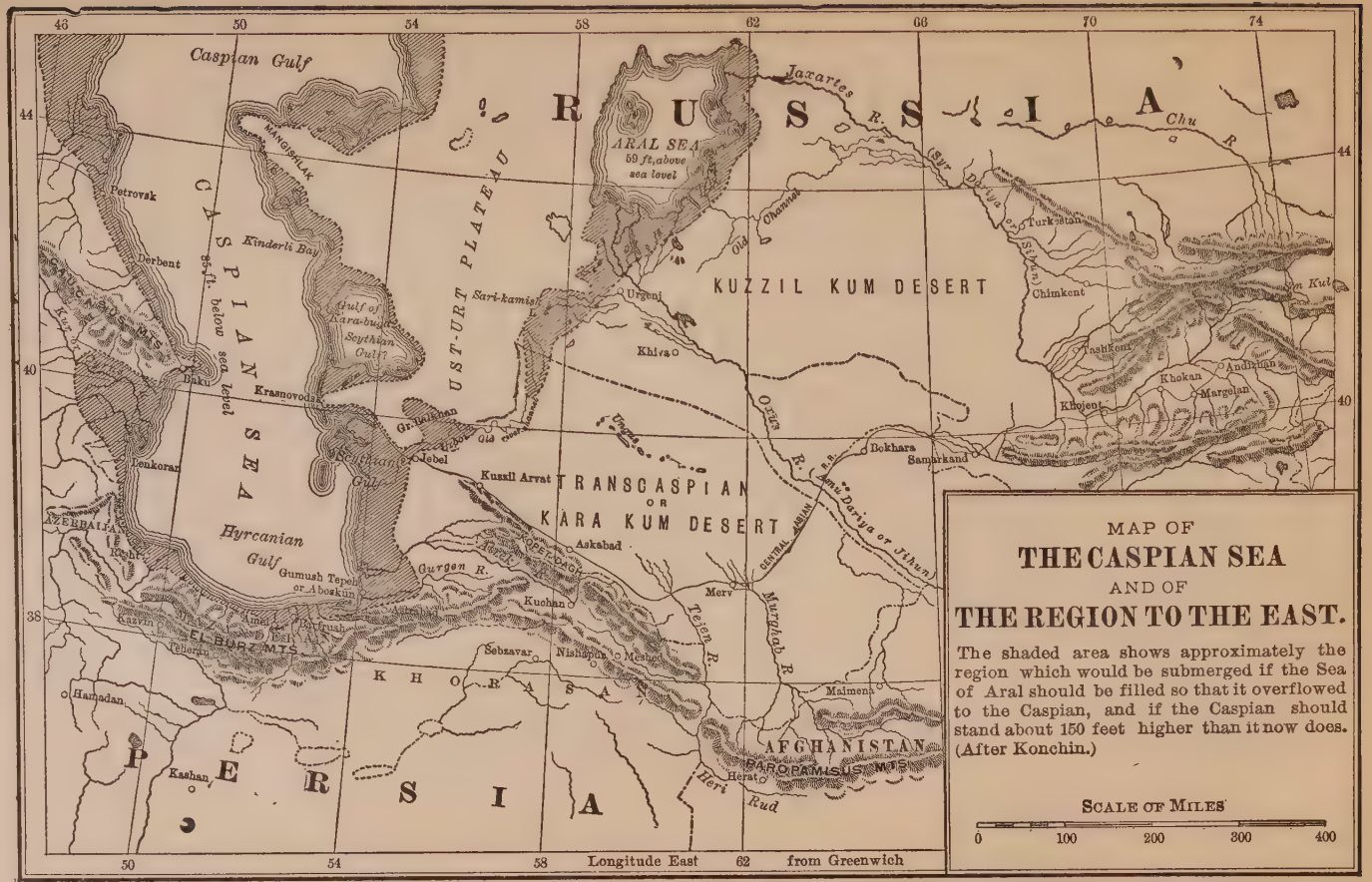
THE CASPIAN SEA AND ITS NEIGHBORS

THE Caspian Sea, like the other enclosed basins which we have examined, has fluctuated in level during historic times. Its relation to the Sea of Aral and to the Oxus River has complicated its history, and has caused much disagreement among modern writers. Humboldt has devoted almost two hundred pages of his great work on Central Asia to the subject; Rawlinson has investigated it carefully; Brückner has made an exhaustive study of the fluctuations of the sea, especially during the last two centuries; and many other writers have contributed more or less to a discussion which began two thousand years ago, and in which no agreement has as yet been reached.

Among the ancients, some considered the Caspian Sea a part of the great "stream of Ocean" surrounding the habitable earth; others supposed it to be one of four symmetrical gulfs which were thought to penetrate from the northern and southern oceans into the dry land; while still others, who knew that it was an enclosed basin, inferred that it must have an underground outlet to the Black Sea, which, as a matter of fact, lies eighty-five feet *above* it. Previous to the days of Herodotus, the Caspian Sea is mentioned only vaguely. Two ancient records, one Greek and one Egyptian, have been supposed to refer to it, and possibly to the Sea of Aral; and the traditions of the Argonauts have been thought to show that water communication

existed between the Black Sea and the Caspian, but there is no certainty in either case.

Herodotus, about B. C. 458, visited Olbia on the Black Sea at the mouth of the Dnieper River. He there obtained from the merchants such accurate information that he was able to state definitely that the Caspian Sea was completely isolated and had no outlet. He makes the north and south axis six times as long as that from east to west, although now it is only between three and four times as long. Of course we have no certainty that Herodotus had anything more than the unreliable accounts of traveling merchants. Nevertheless, it is interesting to see how well his information agrees with the conclusion to which we are led by other evidence. The width of the Caspian Sea between the Caucasus mountains and the Ust-Urt plateau, the part with which the Olbians would be most familiar, is about two hundred miles, and would not be greatly increased even though the level of the water rose several hundred feet. If the length of the sea were six times two hundred miles, water would extend from about its present limit at the foot of the Elburz mountains on the south, to north of Samara in the plains of Russia; and this is just what would happen if the Caspian rose to the level at which there is reason to believe that it stood in ancient times. Herodotus says also that the Jaxartes, or Syr River, after throwing off many small arms to feed a lagoon, which Rawlinson surmises to be the Sea of Aral, entered the Caspian in a single stream. Possibly the Jaxartes may have followed an old channel which, as the map shows, joins the Oxus near that river's mouth; and the united streams may have flowed by another old



MAP OF

THE CASPIAN SEA

AND OF

THE REGION TO THE EAST.

The shaded area shows approximately the region which would be submerged if the Sea of Aral should be filled so that it overflowed to the Caspian, and if the Caspian should stand about 150 feet higher than it now does. (After Konchin.)

SCALE OF MILES

0 100 200 300 400

channel, the Uz-boi, from north of Khiva to the Caspian. The data given by Herodotus as to the Jaxartes do not agree with those of his successors, which may mean either that conditions were subject to change, or that the Father of History, at a distance of fifteen hundred miles from the Jaxartes, could not obtain exact information.

Aristotle, B. C. 348, the next authority on the Caspian Sea, follows Herodotus strictly. A few decades later, Alexander and his generals commissioned some of their subordinates to study the geography of the new regions to which the Greeks had lately penetrated. The geographers did not visit the northern side of the Caspian, but confined themselves to the southern shore south of the Caucasus mountains on the west and of what is now the Sea of Aral on the east. Aristobulus, the geographer of Alexander, is quoted by Strabo as saying that in the fourth century before Christ the traffic from India came down the Oxus River to the Caspian, into which the river apparently flowed; crossed the sea; went up the Cyrus River to its head; down the Phasis to the Black Sea, and so to Europe. A little later, about 300 B. C., Patroclus, the admiral of Seleucus, made a survey of the southern coast of the Caspian. According to his account, the Oxus and the Jaxartes rivers both entered that sea, the mouth of the one being two hundred and forty miles from that of the other. To-day, both streams enter the Sea of Aral, their mouths being about as far apart as they were in the days of Patroclus. Under the present conditions of water supply, it might be possible for the Oxus to flow to the Caspian Sea without entering the Sea of Aral; and even the Jaxartes might possibly pass the Aral depression with-

out entering it, but if it did, the Ust-Urt plateau to the west would force the river so far to the south that it would inevitably join the Oxus two or three hundred miles from the present shore of the Caspian. Therefore under present conditions the Oxus and Jaxartes could not possibly enter the Caspian Sea by separate mouths. If, however, the Caspian were to expand so as to coalesce with the Sea of Aral, or to be separated from it only by a short sound or river, the two seas might be regarded as one, and the conditions would agree with the description of Patroclus. The absence of any distinct mention of the Sea of Aral by either Greeks, Chinese, or Persians down to the time of Menander of Constantinople, A. D. 590, suggests either that no such lake existed, which is extremely improbable, or that it was regarded as a part of the expanded Caspian.

The reports of Aristobulus and Patroclus have been discredited because these men, or some others of Alexander's followers, confused the Paropamisus mountains of Afghanistan with the Caucasus range; and, finding the name of Don or Tanis attached to the Jaxartes, supposed it to be the Don or Danube of Europe. Opinion is divided as to how fundamental their geographical errors may have been. They were probably wrong in saying that the Caspian Sea was a gulf of the northern ocean symmetrical with the Persian gulf on the south, and, like it, separated from the main ocean by a narrow strait. Their mistake, however, is not so great as it appears at first sight. Humboldt, Wood, and others have favored the hypothesis that in ancient, perhaps prehistoric times, the Caspian and Aral seas formed a single body of water, which discharged to the north. The

supposed outlet was from the Aral gulf of the enlarged sea along what has now become a line of lakes leading toward the Irtysh River. The hypothesis lacks confirmation, but the marked physical features upon which it is based may have given rise to the Alexandrine idea of a northern passage leading to the Arctic Ocean. It is not likely, however, that such an idea would prevail unless the Caspian had stood at such a level that it almost or quite coalesced with the Sea of Aral.

Another explanation of the Alexandrine error is possible. When the Greeks inquired as to the northern shores of the Caspian Sea, they would hear that the water stretched away indefinitely to the north, where a narrow channel, the almost motionless stream of the mighty Volga, up which ships can sail for nearly two thousand miles, led far toward the Arctic regions. Under the prevailing ideas as to the symmetrical distribution of sea and land, the geographers would naturally jump to the conclusion that the Caspian Sea was a gulf of the ocean corresponding to the Persian gulf on the opposite side. Such an error would be even more likely to spring up, if the Caspian extended far to the north over the plains of Russia, as the account of Herodotus suggests, discharging, perhaps, through the "Manych" to the Black Sea, as it must have done if it were so expanded eastward that the Oxus and Jaxartes rivers both entered it.

The Alexandrine idea of a northern outlet of the Caspian Sea remained almost unchallenged for nearly five centuries, until the days of Ptolemy. Diodorus of Sicily, B. C. 60, is the only known author who, during this period, speaks of the complete isolation of the sea, and he does so only inci-

dentally. All the others appear to have accepted the Alexandrine accounts as superseding those of Herodotus and Aristotle. As no one visited the northern coasts of the Caspian, there was no means of ascertaining the error. Nevertheless, the later geographers add materially to our knowledge of the shape and size of the sea. Pomponius Mela, A. D. 40, says that it has three main parts, the Caspian gulf to the north, the Hyrcanian to the south, and the Scythian to the east. Pliny, writing in A. D. 69, confirms this. A glance at the map accompanying this chapter shows that the Caspian and Hyrcanian gulfs are easily recognizable. In regard to the Scythian gulf, there is some question. The bay of Kara-Bugas is the only modern feature which could answer to it. It is possible that, although this bay is very small compared to the Caspian and Hyrcanian gulfs of Pomponius, it may nevertheless be his Scythian gulf. It should be noted, however, that the bay of Kara-Bugas does not now lie upon a trade route of any importance, and apparently never has done so. Therefore it is not probable that the Greeks and Romans knew much about it. If the Caspian stood a hundred or more feet higher than it now does, the size of Kara-Bugas would not be appreciably changed, since its shores are high. A new and larger gulf, however, would come into existence south of Krasnovodsk, as is shown by the shaded area on the map. The great trade route from the East to the West must have traversed this gulf if it existed, for it lies between the mouths of the Oxus and Cyrus rivers. The Greeks and Romans would surely have known of it. In view of the other evidence as to the former expansion of the sea, it seems probable that this is the true Scythian gulf.

Strabo, A. D. 20, furnishes evidence more exact than that of Pomponius and Pliny. He gives data as to the distance from the mouth of the Phasis River in the Black Sea to that of the Cyrus in the Caspian, as to the sandy plain on the west coast of the Caspian, and as to other features. His figures agree in indicating that at that time the sea stood higher than now. From them Khanikof has estimated that in the first century of our era the level of the Caspian Sea was eighty-five feet higher than now. If this is true, the Scythian gulf must have extended far toward the Sea of Aral, with which, at an earlier, higher stage, it may almost have coalesced.

The last ancient author who makes any important contribution to our knowledge of the Caspian Sea is Ptolemy, A. D. 160, one of the most accurate among Greek geographers. He abandoned the Alexandrine idea of a northern outlet, and asserted that the sea was completely enclosed. His map makes it over twice as long from east to west as from north to south. Apparently, when he became convinced that the sea was not connected with the northern ocean, he supposed the so-called Caspian gulf to be also a mistake, and accordingly made the sea consist of only the Hyrcanian and Scythian gulfs.

Most of the information of the preceding paragraphs has been gleaned from Humboldt's great book, "Asie Centrale." In dealing with records of ancient authors, two mental attitudes are possible. One, exemplified by Murchison in his paper on the Caspian, assumes that the ancients were essentially wrong, and that their geographical accounts are worth studying only as literature. The other, exemplified by Hum-

boldt, assumes that the ancients were much like the moderns, generally right as to facts of personal observation, but often wrong in their inferences, and not always careful to distinguish between the two, or between information acquired first hand, and that quoted from others. If we adopt the second attitude, it is impossible to reconcile the ancient accounts with the facts, unless we accept the hypothesis that in the days of Herodotus and Alexander, over twenty-two hundred years ago, the Caspian Sea stood nearly a hundred and fifty feet higher than now, and almost coalesced with the Sea of Aral. Three or four centuries later, at the beginning of the Christian era, the water had apparently fallen to a level a hundred feet or less above that of to-day, the sea being still much larger than at present.

It is not possible as yet to connect any physiographic evidence directly with the high stand of the Caspian Sea which we have inferred from the data of history. Nevertheless, as many writers have noted, and as I saw in 1903 when traveling with Professor Davis, the sea is bordered by abandoned strands lying at various heights up to six hundred feet above the present water-level. The state of preservation of the lower strands, and of some of the upper ones, such as that six hundred feet above the sea at Baku, shows that they are of very recent origin, though no one has yet succeeded in correlating them with any events of human history. Their weak development shows that, as a rule, the sea did not stand at any one level for a long time. Other features, as Professor Davis has pointed out, suggest that the strands were formed by a lake which alternately rose and fell, as would happen during alternate fluvial and inter-fluvial epochs. At Jebel

on the Central Asiatic railroad, a hundred miles east of the terminus at Krasnovodsk on the Caspian Sea, we saw two particularly interesting strands at an elevation of two hundred and fifty and one hundred and fifty feet above the Caspian. The lower occupies the position where, according to the conclusion reached above, the shores of the Scythian gulf stood in the days of Herodotus and his successors.

If we admit that such an expansion of the Caspian Sea is an historic fact, the question arises whether it can be explained without postulating a change of climate. An increase in the amount of water used for irrigation during more recent times cannot be appealed to, for it is generally admitted that the population and hence the consumption of water in the Aralo-Caspian basin was greater in ancient than in modern times. Warping of the earth's crust will not explain the matter, for granting that the position of the sea may have been altered by this means, the water-spread, or surface exposed to evaporation, would remain practically constant so long as the climate remained constant. The water-spread of ancient times, however, appears to have been very great, possibly almost double that of to-day. Changes in the course of rivers are an equally inadequate explanation, for the same reason. The Oxus and the Jaxartes are the only rivers which have been seriously suggested as possible contributors to the expansion of the Caspian Sea. Between them they furnish most of the water which balances the evaporation from the 26,000 square miles of the water-spread of the Sea of Aral. Even if they could avoid depletion by underground drainage into the basin of Aral, two hundred and twenty feet below the present level of the lake,

they would still have to meet the losses incident to a course of nearly four hundred miles through the sandy desert without reinforcement from tributaries before reaching the Caspian. On the way, they would have to maintain a lake in the depression of Sari-Kamish (Yellow-Reeds), which lies in the course of the old Uz-boi channel, for its bottom is fifty feet below the level of the Caspian Sea. Having met all the losses, the united streams would by no means be able to add 26,000 square miles to the water-spread of the Caspian. The inferred expansion, however, amounted to far more than this. Apparently, we must either disregard the ancient authorities entirely, or else admit a change of climate. The climatic hypothesis is supported not only by the agreement of the phenomena of the Caspian with those of distant regions, but by the fact that ruins such as those of Merv and Bal Kuwi, which are now inadequately supplied with water, appear to be typical of many in the Aralo-Caspian basin, where streams have diminished in size during historic times.

Returning once more to our investigation of the varying level of the Caspian Sea, we find a surprising change between the conditions in the first century of the Christian era and those of four or five centuries later. Near the beginning of our era, the trade route from Europe to India altered its course, as did the one from China to the West. It ceased to go up the Oxus, perhaps because the Caspian had so far contracted that the river no longer reached that sea, but fell into the now isolated Sea of Aral. The new route crossed from the mouth of the Cyrus River to the southwest corner of the Caspian, where in time there grew up a flourishing

seaport, called Sokona, or Aboskun (Water of Oskun, or Sokona), at the mouth of the Gurgen River. The site of Aboskun is marked by the ruins of Gumush Tepeh, or Silver Hill, from which the so-called "Red Wall," a great bulwark against the Huns, stretches eastward to the mountains in a line of mounds a hundred and fifty miles long. The Caspian Sea, to quote Rawlinson, "must have been at a very low level when Aboskun and the great wall were first commenced, if it be true, as the Russian surveys report, that remains of masonry along the line of the wall can be traced below water eighteen miles from the shore." O'Donovan and Eichwald also speak of the wall, and of a caravanserai of Aboskun which now lies under water. The most reliable and ancient Persian tradition, according to Rawlinson, relates that the wall was built by the Sassanian king, Firuz, against Kiyataleh, between A. D. 459 and 484.

At Derbent, on the western shore of the Caspian Sea, four hundred and fifty miles from Aboskun, there is a great wall of the same sort, supposed to have been built in the fifth or sixth century of our era. Its base is said to be slightly under water. In the bay of Resht, according to Brückner, there are houses of unknown date standing in the sea, although they certainly were built on dry land; and Sokolof relates a Persian account of the ruins of a submerged city near the mouth of the Kur, or Cyrus River. Finally, at Baku we saw the towers of a well-preserved caravanserai projecting above the water some distance from the shore. Their base lies fifteen feet below the level which Brückner has taken as zero in his investigations of the fluctuations of the sea. Lenz believes that the caravanserai dates from before

the founding of Baku in its present site in the fifth or sixth century; but Brückner, on the basis of architectural resemblances, considers it of Arab origin, dating from the twelfth century. However this may be, the walls of Aboskun and Derbent are sufficient to establish the fact that about 500 A. D., the level of the Caspian Sea was as low or lower than it is to-day. The climate must then have been at least as dry as it now is.

During the succeeding Middle Ages, there is unmistakable evidence that the level of the Caspian Sea again rose, though not to such an extent as formerly. So far as the water-spread of the mediæval sea is concerned, it is probably possible that the expansion of the sea may have been due to the deflection of the Oxus and Jaxartes from the Sea of Aral to the Caspian. There is evidence that such deflection took place, or, at least, that part of the water of the rivers was so deflected. Hence it is necessary to proceed with the greatest caution, in order to ascertain whether the epochs of high level agree with those of deflection, or whether the expansion of the lake occurred independently of the river. The chief evidence, one way or the other, is found in the works of various Arab and Persian authors quoted by Humboldt and Rawlinson. I shall assume that the oriental authors state the facts correctly, unless there is clear reason for doubting their information.

During the Dark Ages, in the seven and a half centuries between the times of Ptolemy and of Istakhri, A. D. 920, war and confusion prevailed in the Aralo-Caspian region. The only addition to our knowledge of the two salt lakes is Menander's mention of the existence of the Sea of Aral as a

great lagoon. With Istakhri, however, we enter upon a new era, a time when the Arabs and Persians rose to a high state of civilization and produced a literature of great excellence. They were especially proficient in geography and related sciences, and have left several works of high accuracy. One of the best of these is that of Istakhri. He corrected the Alexandrine idea of a northern outlet of the Caspian Sea, which, in spite of Ptolemy, was still prevalent. In a journey around the sea he came to Derbent, where he records that the old wall projected into the sea so far that six of its towers stood in the water. Brückner considers that there is good evidence that none of the towers have disappeared, and therefore concludes that about 920 A. D., at the time of Istakhri's visit, the Caspian stood twenty-nine feet higher than the modern mean level, or zero. Now at that date the Oxus quite surely did not enter the Caspian. Istakhri's map shows it as entering the Sea of Aral, whose circumference is said to be one hundred parasangs, nearly four hundred miles. Moreover, Istakhri says distinctly, "Aral receives the Oxus, the Jaxartes, and several other rivers. Nevertheless, one perceives no increase in its waters; and so one supposes a subterranean communication with the Caspian Sea." If there had been a visible communication, he surely would not have made such a supposition. Elsewhere he speaks of the mouth of the Oxus as being ten days' journey, about two hundred and fifty miles, from that of the Jaxartes; but there is no hint of any connection with the Caspian. In describing the lake, he says, "On the shore itself of Aral there is a mountain called Sheghagher, on which snow remains from winter almost to the end of summer." So far as I can learn,

there is now no place near the Sea of Aral where snow stays so long.

The next important author, Edrisi, A. D. 1154, speaks of Aral as "a well-known lake," and confirms most of what Istakhri says, including the snow. He gives the distance, however, between the mouths of the Oxus and Jaxartes in Lake Aral as only ten miles. This apparently means that the Jaxartes had then changed its course to the old channel already referred to in connection with Herodotus, a course which it appears to have followed intermittently. It flowed there as late as 1816. Of the Caspian Sea, Edrisi says that "it is elongated from north to south *less* than from east to west. [The italics are mine.] The two axes have the ratio of four to three." His map, however, shows it otherwise. It seems as if we had here a revival of the Scythian gulf, either because Edrisi had read Ptolemy, or more probably because the rising water of the Caspian had once more broadened the southern end of the sea.

According to Rawlinson, "The Arab geographer Yacut . . . about A. D. 1225 furnishes the earliest record of the Oxus having found its way into the Caspian, after it had been turned into its old bed by the Moghuls at the siege of Urgenj [ancient Khiva] in 1221." Rawlinson, it should be said, believed that in ancient Greek times the Oxus flowed to the Caspian. Hence his reference to the "old bed" into which the Mongols diverted the river. Abdulfeda, seventy or eighty years after Yacut, describes the Oxus and Aral in essentially the same way as Istakhri and Edrisi, with no reference to any connection with the Caspian. Possibly the overflow of the Oxus to the Caspian lasted only a few years.

A later writer, however, Hamdulla the Persian, in 1325 A. D., tells us that Aboskun was then under water because the Oxus had been diverted from its old course about the time of the Mongols. He probably refers to the siege of Urgenj, and assumes that the water had remained high ever since, which may or may not have been true.

A few years before the date when Hamdulla wrote his account, there had been another sudden rise of the Caspian Sea. This may have been due to a temporary diversion of part of the Oxus. Brückner tells us that according to a story related by Marino Sanuto, the underground outlet by which the natives supposed the Caspian Sea to drain to the ocean was closed by an earthquake, whereupon the sea rose rapidly at the rate of about thirty-two inches a year, and some towns were submerged. Sheikh Sefi-Eddin says in reference to this, that the water reached a certain holy grave, well known even now, which lies thirty-seven feet above the present datum-level, and then, in the winter of 1306–07, began to fall. Now this date, be it noted, is within a year of the time when the Dragon Town on the shore of Lop-Nor was overwhelmed by the rising of that lake. It is possible that at about this time there may have been a period of unusual rainfall, which caused the rivers and lakes to rise until the water of the Tarim overwhelmed the Dragon Town, and that of the Oxus broke from its old channel and flowed to the Caspian, causing a sudden rise of that sea. It was no such accident, however, which caused the original submersion of the ruins of Aboskun, as Hamdulla implies, for they were certainly under water in Istakhri's day, four centuries earlier, when the Oxus did not flow to the Caspian.

Apparently, from 1221 A. D. onward for some centuries the Oxus bifurcated at certain times, one stream flowing to the Sea of Aral and one to the Caspian. Hamdulla, who has just been quoted, distinctly mentions such a bifurcation. He adds that the Sea of Aral had a compass of one hundred parasangs, from which it appears that the diversion of part of the Oxus had not materially diminished the lake. A century later, a Persian writer, Sultan Shah Rukh, in whom Rawlinson puts much confidence, tells us that "in all ancient books the lake of Kharesm [Aral] is described as the receptacle of the waters of the Oxus, but at the present date, which is A H 820 [A. D. 1417], the lake no longer exists, the Jhelum [Oxus] having made a way for itself to the Caspian, into which it disembogues at a place called Karlawn, or Ak-richeh." Elsewhere Shah Rukh repeats this assertion. He further says that "the river of Khojend [the Jaxartes] in the lower part of its course, after passing into the desert of Kharesm, joins the Jyhun or Oxus, and thus ultimately reaches the Caspian." Rawlinson takes this to mean that the Jaxartes followed the old channel already referred to, branching southwest below Otrar and joining the Oxus below Khiva, and that the united streams flowed to the Caspian through the Uz-boi, or old channel of the Oxus at the foot of the Ust-Urt plateau. If this is so, the Caspian ought to have stood at a comparatively high level, as apparently it did, to judge from the following quotation from Brückner: "Bakui informs us that early in the fifteenth century the sea swallowed up a part of the former city of Baku, and that in his time the water stood at the level of a still existing mosque. Apparently, we have here to do with an expansion of the sea

and a subsequent standstill." The mosque is sixteen feet above Brückner's zero.

In spite of Shah Rukh, one is inclined to doubt whether the whole stream of both the Oxus and the Jaxartes ever entered the Caspian, leaving the Aral to dry up entirely.

At any rate, only fifty years later, in 1470 A. D., Said Abdul Hassan says that "the river Amu, the great Jihun [Oxus], is the river which debouches in the Caspian Sea; it is also the Kharesm Jihun which goes to Baheira Kharesm [the Sea of Aral]." Abdul-Ghazi, prince of Urgenj, or ancient Khiva, writing about 1632 A. D., gives a detailed account of certain changes in the Oxus: "In A. H. 880 [A. D. 1475], communication between Urgenj and the country of Abul-Khan [the Ust-Urt plateau] was very frequent; because the river Amu [Oxus], after having passed under the walls of Urgenj, directed itself [along the Uz-boi channel] toward the eastern portion of the mountain of Abul-Khan, then toward the south following the base of the mountain, then toward the west. The river passed near Oghurja and finally discharged its waters into the sea of Mazanderan [the Caspian]." Again, he says that "[in A. D. 1575] thirty years before his birth, the Amu at Kara-Uighur-Tokai detached an arm [on the right], which passed the city of Tuk, and threw itself into the sea of Syr [Aral]. It was by this accident that the country of Urgenj has become a desert for lack of water. . . . The place of the embouchure of the [new] river received the name Aral six months after the death of Essen [A. D. 1622]."

From the information given by Abul-Ghazi, it is not clear whether the branch of the Oxus which in 1575 was diverted

from Urgenj had formerly flowed to the Sea of Aral or to the Caspian. The account of Jenkinson, an English merchant who came down the Volga to the Caspian, and thence to Urgenj, in 1559, indicates, however, that it flowed to the Aral. Jenkinson saw the mouth of the Uz-boi, and was told that formerly the Oxus discharged there, but had lately changed its course and gone back into the Sea of Aral. In coming to the Uz-boi, the Englishman sailed along the eastern coast of the Caspian near Mangishlak, and found deep water close to a shore where streams and trees abounded. To-day, as Rawlinson points out, the water is so shallow that no ship can approach the shore, and no one would think of describing the coast as abounding in streams and trees. This implies that the level of the lake was high. A similar implication is found in the atlas of Ortellius, dated 1562, which shows a deep gulf of the Caspian extending far toward Khiva — probably the Scythian gulf once more.

After the days of Jenkinson, the Oxus appears never to have flowed to the Caspian. Hanway, in 1743, and later travelers merely heard traditions of the drying up of the Uz-boi "a hundred years ago," or "long ago in the days of our fathers." Even before the time of Hanway, when Kitab Chelebi (Book Gentleman) wrote, about 1650, the fact of the discharge of the Oxus into the Caspian was known only from books and tradition. Kitab Chelebi, commenting on the statement of Hamdulla already quoted, that the Oxus in 1359 flowed partly to the sea of Aral and partly to the Caspian, remarks: "There exists an arm of the Jihun [Oxus] which, after having passed the capital of Khowaresm

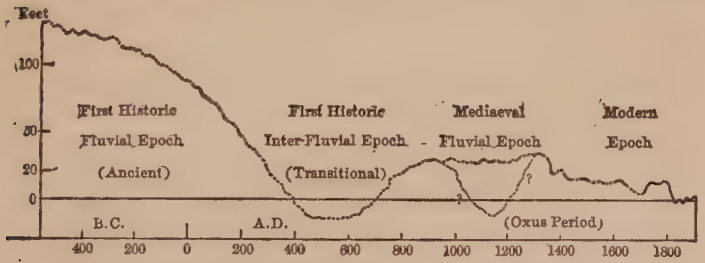
[Urgenj or Khiva], enters a narrow rocky valley called by the Turks Kerlawa [the Kerlawn of Abdul-Ghazi]. This arm afterward forms a cataract, where it falls with a frightful noise. According to Hamdulla, this arm of the Oxus discharges into the Caspian. . . . Ebn-Haukal and Abulfeda [both about 1300 A. D.] say that the embouchure of the Jihun is in the lake of Aral, but we may believe that it is only the principal branch of the river of which those authors have meant to speak."

Kitab Chelebi speaks only as a commentator, and adds nothing to our knowledge of the relation of the Oxus to the Caspian, except in one respect. His mention of a cataract or rapids in the Uz-boi channel is in harmony with what has been recorded by modern geologists. Several observers, to quote Davis, "have noted that the gentle southwestward descent of the channel is broken by the sills of rapids at several points, from which it may be inferred that the stream by which the channel was eroded did not endure long." Moreover, the Uz-boi channel is "decidedly smaller than that of the Amu to-day," from which it may be further inferred that it never carried the whole stream of the Oxus, and far less the combined Oxus and Jaxartes.

After the time of Jenkinson, A. D. 1559, the level of the Caspian still remained high, although, as we have seen, there is no evidence that the sea was reinforced in any way by the Oxus. A sketch made in 1638 by Olearius shows that the sea stood then at the third tower of the wall at Derbent. Brückner says that "according to Khanikof, there is even to-day a clearly visible horizontal line of disturbance like an old strand, the same on which the sea of the representation

of Olearius stands; and truly the great clearness of the line speaks for a very long stand of the water at this height." If the high stand of the water at this time were due to the inflow of the Oxus, which had come to an end over eighty years before, there could not possibly have been "a very long stand of the water at this height." Unless the climate were different from that of to-day, evaporation would have lowered the sea steadily year by year until it was reduced to its modern level.

From the time of Olearius down to the present day, data as to the level of the Caspian become more and more abundant and trustworthy. As collected in Brückner's excellent summary, they show that there was a rather low stand early in the eighteenth century, followed by a somewhat higher



APPROXIMATE CHANGES IN LEVEL OF THE CASPIAN SEA
Referred to Brückner's Datum-Level, 85± ft. below Sea-Level.

stand till about 1820. Since then the level has been low, with many minor fluctuations, as is indicated in the accompanying diagram.

The evidence of the high stand of the Caspian Sea during the Middle Ages is so abundant that there is little need of citing the maps of the period. The majority were drawn in Europe, and are based partly on ancient and partly on con-

temporary materials. One shows a bifurcation of the Oxus; another shows the river as entering the Sea of Aral; and a third as entering the Caspian. The majority show an enlarged Caspian and no Aral. Humboldt says of them: "The maps of the Middle Ages, of which I have made a particular study, seem to indicate that the Scythian gulf of the Caspian [was] much more extended to the east than in our day, [and] has by mistake been made to include all the lake of Aral."

To sum up our conclusions as to the Caspian during the Middle Ages, there can be little doubt that the level of the sea has been influenced by changes in the course of the Oxus River. On the whole, however, the fluctuations of the lake do not correspond to the variations of the course of the river; and the influence of the Oxus appears to have been of minor importance compared to that of some other factor. At most, only a part of its water ever seems to have reached the Caspian, and even that for only a few centuries, from about 1200 to 1550 A. D. at the outside, during the time designated as the "Oxus Period" in the diagram. It is probable, moreover, that the Oxus never flowed permanently to the Caspian, but intermittently for a few score years at a time. As early as 920 A. D., the sea had attained a high level, but it was not till three centuries later that the Oxus was first diverted to it. Again, the last notable contribution of the river to the sea had come to an end before 1550, but the sea remained at a high level till at least 1638. Thus it appears that the mediæval high stand of the Caspian was not due to the diversion of the Oxus, but to some other cause, and that cause appears to have been climatic.

If we accept this conclusion, the diagram on page 349 may be interpreted as the climatic curve of the Aralo-Caspian basin. Except during the last two centuries, the details are uncertain. There have probably been notable fluctuations of which we have no record. One such is suggested by the dotted line between 900 and 1200 A. D. If Brückner is right as to the date of the caravanserai at Baku, a short dry period must have ensued after the moister period indicated by the account of Istakhri. Making due allowance for the defects of our knowledge, there remains a strong presumption that the Aralo-Caspian basin has passed through a double series of great climatic changes during historic times. During the period commonly called antiquity, the climate was apparently damper and cooler than now. This first historic fluvial epoch gave place during the Dark Ages, Emerton's Transitional Epoch, to the first historic interfluvial epoch, during which the climate was warmer or drier than to-day. In the course of the next few centuries there was a change to the somewhat damper or cooler conditions of the mediæval fluvial epoch; and this in turn has been succeeded by the modern dry epoch.

The most significant feature of the climatic curve of the Caspian Sea is that it is applicable to the whole of western and central Asia. Two examples will show how the climatic hypothesis illustrated in the diagram throws light on, and is confirmed by, hitherto inexplicable phenomena of distant regions. Around the little lake of Son Kul, which we visited with the Khirghiz in the western Tian Shan mountains a thousand miles east of the Caspian Sea, Professor Davis and I found in 1903 the remains of a number of old irrigation

canals. They were located on the mountain sides at an elevation of from 10,000 to 10,500 feet above the sea. As we concluded at the time: "They must be hundreds, possibly thousands, of years old, since they are thoroughly graded, and are sometimes wholly obliterated for a space. They cannot be of extreme age, however, for many can still be traced throughout their entire length, although they lie across slopes of considerable steepness, where erosion is so rapid that such small features must soon be eradicated. They must be irrigation canals, for they contour around the hills, are broad enough to carry most of the water of the streams from which they diverge, and come to an end in places suitable for fields. The peculiar feature is that they lie at a great altitude, where there is now no agriculture, nor could be, it would seem. Snow falls at Son Kul, so the people say, during all but two months of the year. On the morning of July 8, at the altitude of the upper canals, I walked on new snow which was said to have been a foot deep a few days before. The next morning, near the shore of Son Kul, below the level of the fields once watered by the canals, the ground was stiff with frost, and the little pools on the edges of the brooks were skimmed with ice. Moreover, if agriculture were possible under such conditions, irrigation seems unnecessary. In July, the ground was saturated with moisture, and the natives told us that the grass is always as green as when we saw it [in summer, at least]. The simplest hypothesis is that at some time since the human occupation of the country, the climate was warmer, and therefore drier than now, but this cannot be proved. In regions such as Transcaspia and Persia, there is strong evidence of a greater water supply

during antiquity. It is hard to reconcile the two sets of facts, but it may be that climate is more changeable than has been supposed, and that since the dawn of history man has passed through more than one change between colder and warmer, or moister and drier conditions. If this has been the case, the course of history must have been deeply affected by geographic causes as yet uninvestigated."

Now, in the light of four years' further study, it seems probable that the canals were built during the first historic inter-fluvial epoch, probably between 300 and 800 A. D. If the climate were then so warm and dry as is indicated by the low stand of the Caspian Sea, agriculture would have been possible, and irrigation would have been necessary in places like Son Kul, which are now too cold and wet for either. The people who were forced out of the warm, dry lowlands by increasing aridity would naturally betake themselves to available spots in the highlands. They could not practice agriculture long at Son Kul because the succeeding mediæval fluvial epoch caused the climatic conditions to become unfavorable once more at a high elevation; although at lower elevations the habitability of the country became much greater.

A second illustration of the manner in which the climatic hypothesis, as exemplified in the curve of the fluctuations of the Caspian Sea, throws light on difficult problems is found in Turkey. Two thousand miles west of Son Kul, the Armenian lake of Gyoljuk, twelve miles long by two or three wide, lies at an elevation of 4000 feet among the Taurus mountains, between the headwaters of the Euphrates and Tigris rivers. In 1899 and 1900, when I mapped and

sounded the lake, it overflowed throughout the year, and formed one of the most remote sources of the Tigris. Those years, however, were a time of large rainfall, not only in Turkey, but in the continental regions of the world as a whole. In drier years, the lake is said to have no overflow during the long rainless summer. In 1879, which was also a time of comparatively abundant rainfall, Tozer records that the water had recently begun to overflow. Nevertheless, during most of the last century, the lake-level must have been lower, for the natives are unanimous in saying that previous to 1878 the water, sometimes at least, stood many feet below the present strand. The impregnation of the clear blue water with borax also indicates that in recent years the lake has at some period been without an outlet. The borax comes chiefly from large deposits about three miles east of the lake. Its amount is not so great as to render the water undrinkable, or even distasteful if one is thirsty; and animals drink from the lake freely. Apparently, under the present climatic conditions the lake is on the dividing line between a so-called "normal" fresh-water lake with a permanent outlet, and a salt lake with no outlet.

In former times Lake Gyoljuk appears to have fluctuated in size in the same fashion as the Caspian Sea and the distant lakes of Seyistan, Lop, and Turfan. The first historic account of Gyoljuk is that of Ptolemy, in the second century of our era. He calls it Lake Thospitis, apparently equivalent to the name Dzopk, by which the Armenians still know it. He merely says that it lies four degrees — actually three — west of Lake Arsissa, the modern Van, and that the Tigris River flows from it, which is exactly what a modern geo-

grapher might say. The condition of the lake in his day was probably very much the same as it is to-day. Later, however, there appears to have been a change. Near the south shore of the lake there is a little island, on which stand the ruins of an ancient Armenian monastery. Around it the stone houses of an ancient village can be seen submerged in water to a depth of twenty or thirty feet. Local tradition, recorded in a book preserved till the massacres of 1895 in a neighboring Armenian village, relates that the monastery was built about A. D. 500 or 600, at which time the island was part of the mainland. The present bed of the lake, so the record goes, was a cultivated plain, through the middle of which flowed a stream. The stream disappeared at the lower end of the plain, but reappeared beyond the mountains, where it joined the Euphrates. Gradually the underground exit was closed with silt, and the plain was converted into a lake. The reduced size of the lake at some historic period is proved not only by the Armenian monastery, but by a line of forts. The forts, which are from one to two thousand years old, plainly mark the course of an important road from Harput to Diarbekir running directly across what is now the bed of the lake at a point about four miles from its western end.

As to the supposed underground outlet, I could find no proof of its existence, though I searched diligently. Nevertheless, in spite of the improbability that a lake which had existed for ages, as is shown by its deposits in deltas and beaches, should be drained by a temporary underground outlet, which soon became clogged again, I accepted such an hypothesis in 1900 as the most probable explanation.

The only alternative seemed to be the hypothesis of a change of climate, which I then thought "contrary to the facts of history." Now, however, I am inclined to believe that it accords with the facts of history. The close agreement of the fluctuations of Lake Gyoljuk in date and character with those of the Caspian Sea, and the fact that a single hypothesis fits the phenomena of both lakes, give good ground for believing that Turkey has been subject to the same changes of climate as has Central Asia.

The extent and possible significance of these changes will be manifest from a brief résumé of the main conclusions to which we have thus far been led. Including Gyoljuk, our survey of western and central Asia has dealt with six distinct basins. On the west lies Gyoljuk in Turkey; then come the Caspian basin in Russia, and that of Seyistan to the south in Persia; while far to the east we have Lop and Turfan in the heart of Asia forming part of China, and Kashmir south of the Himalayas in India. If we omit the Volga and the European portions of the Caspian drainage area, the limits of our six basins lie over sixteen hundred miles apart from north to south, and over three thousand from east to west. All this vast area seems to have been subject to the same great waves of climatic change.

In the ancient days when the Oxus River entered the Scythian gulf of the expanded Caspian Sea, and Lake Gyoljuk discharged permanently to the Tigris, the lake of Seyistan had not yet been converted into dry land by the giants; Kashmir was so cold and snowy that agriculture was impossible; its people were nomads, who were obliged to drive

their flocks southward in winter to the warm plains of India. In the Lop basin an opposite state of affairs prevailed, and conditions were highly favorable. The rivers were full of water; Lop-Nor was the "Great Salt Lake;" the desert was comparatively small and the zone of vegetation extensive; and on all sides there was a density of population and a degree of prosperity far beyond those of to-day. And in the Turfan basin the same was probably true.

A great change took place throughout the six basins during the early centuries of the Christian era. The lakes of Gyoljuk, Seyistan, the Caspian, Lop-Nor, and presumably Turfan were greatly reduced in size. In the case of the first three, parts of the old lake-beds were utilized as sites for villages. Except in Kashmir, the change of climate appears to have brought disaster, although in Turkey the question has not yet been investigated. In the other regions, scores of once prosperous oases were abandoned for lack of water. A few of the displaced inhabitants probably went into the mountains and dug canals such as those of Son Kul. Others perhaps went to Kashmir, which now became warm enough for agriculture, and hence able to support a far larger population. The rest appear to have been impelled to start hither and thither in waves of migration to confound the civilized world.

Again there came a change. The process of desiccation gave place to a slight, but important tendency toward increased rainfall and lower temperature. Kashmir became colder and more snowy, and hence more isolated; the rivers of Lop and Turfan gained greater volume; and the lakes of Lop, the Caspian, and Seyistan expanded once more. The

habitability of the arid regions began to increase; migrations came to an end; and Central Asia was prosperous for a time. Finally, a latest and slightest change took place in the other direction; and we seem to-day to be in the midst of an epoch of comparative equilibrium, with no marked tendency toward climatic change in either direction.

CHAPTER XVIII

THE GEOGRAPHIC BASIS OF HISTORY

In studying the geography of Central Asia, we have come to three main conclusions. In the first place, we have seen that not only the habits, but to a large extent the character, of the people of Central Asia appear to have been moulded by physiographic environment. In the second place, we have concluded that, during historic times, climate, the most important factor in that environment, has been subject to notable changes. And finally, it appears that the changes of climate have caused corresponding changes not only in the distribution of man, but in his occupations, habits, and even character. We must now go a step farther, and must see whither we are led if we accept without further question the validity of these three conclusions. If they are true, it appears that geography, especially through its influence upon character, is the basis of history in a way that is not generally recognized; and that climatic changes have been one of the greatest factors in determining the course of human progress. This conclusion applies primarily to Central Asia, but there is strong reason to believe that it is equally applicable to western Asia, north Africa, and Europe. Apparently, the same is true of America and of the continents of the southern hemisphere, but it is impossible to consider them here.

The geographic basis of history, as distinguished from the non-physical basis, with which we are not now concerned, consists of what may be called permanent facts, on the one

hand, and changeable facts, on the other. The permanent facts — which are permanent historically but by no means geologically — are exemplified by the relief of the lands, the distribution of water, and above all, the great difference in temperature between the cold polar regions and the warm torrid zone. The changeable facts include not only accidental occurrences, such as earthquakes, volcanic eruptions, the swing of rivers into new courses, hurricanes, and the like, but also changes of climate of longer or shorter duration, which are vastly more important than the others.

Few people doubt the importance of the permanent facts of geography in determining the course of history; although, as it seems to me, their influence upon human character needs greater emphasis than is usually given to it. The main movements of population have been east and west in Eurasia because mountains and deserts interpose barriers in the other direction. England's commercial supremacy is due in part to her insular position on the border of the comparatively narrow sea between Europe and America, and in part to the presence of coal and iron in close proximity. France and Austria have often battled in the valley of the Po because narrow gaps at either end of the Alps gave both countries ready access; and the outcome of more than one battle has depended on the ability of one of the contestants to entrench its army behind a river flowing southward from the Alps to the Po. Napoleon said that the cold of Russia and the heat of Syria were the most unconquerable enemies that he ever met.

The illustrations just given relate to the physical side of the geographic control of history. A far deeper and more

important aspect of the subject is found in the influence which physiographic environment exerts upon human character. We have seen that the plateaus and deserts of Central Asia entail upon the Khirghiz the nomadic life, and this accentuates certain characteristics, such as hardihood, hospitality, laziness, morality, and family affection. The oases of the basin floors, on the other hand, cause the Chantos to practice intensive agriculture; and the sheltered easy life, thus made possible, seems to induce weakness of will, cowardice, immorality, and the weakening of those ties between parents and children which lead to careful training of the growing generation. Doubtless religion and other causes play an important part, but still there remains much of the character of the Chantos and Khirghiz which owes its origin more or less directly to physical conditions. This is probably true of all races. Not that a single individual's character in a civilized community is directly influenced to so great an extent by the inorganic world around him. He inherits, or receives through the training of others, most of what he is. Nevertheless, inheritance is merely the summation of past training: the training of the average man is strictly in accordance with the social order in which he is born; and the social order owes much of its character to the sea, the plains, the forest, the mountains, or the factory river, by which the occupation of the majority of the people is determined. Those who belong to the so-called upper classes of society are apt to forget that the *average* man is limited by physiographic conditions much more closely than they; and the limitations become closer the farther back we go toward the savage state. When all this is considered, it becomes

almost impossible to assign limits to the influence of physical environment upon character.

The philosophical historian recognizes more or less completely that history is the record of human character as expressed in action. A migration is not a mere unrelated event: it is the expression of a spirit of discontent, or of a desire for something unattainable under existing conditions. Probably no leader, however gifted, has ever persuaded a thoroughly contented people to abandon all that they love and migrate to the unknown. The wars of Rome, her wide conquests, and her laws loom large in history; but after all, they are outward signs. Rome was invincible and her leaders were great in war and peace because her people, her average men, were strong in body, resourceful, brave, temperate. When they became cowardly and self-indulgent, Rome fell. The people of the United States do not speak English to-day solely because England lies on the European border of the Atlantic Ocean. Spain, Portugal, and France also lie in highly favorable positions. At first they dominated America; but there was something in English character, a tenacity of purpose and a degree of energy, which outstripped all rivals. In these and countless other cases history is fundamentally the expression of human character. In these instances, as in Central Asia, the development of character has probably been deeply influenced by geographic environment. Therefore geography must be reckoned with in attempting to understand not only the outward details of history, but the great events which express the character of races.

It may be said that if character is so profoundly influenced

by geographic environment, why is not Rome as great to-day as in the past? Or why has Persia, which once shared many of the virtues of ancient Rome, now become one of the most degenerate of nations? I do not underrate the influence which growing wealth and luxury doubtless exerted. They were due in part to the growth of commerce, and in that respect were geographic. A more potent cause, especially in the case of Rome, was the invasion of barbarians, due apparently, as various writers have suggested, to changes of climate. Another possibility, applicable particularly to Persia, is illustrated by a story told by Malcolm. An English resident in Persia fell into a discussion with a neighbor there over the native habit of lying. He insisted that lying was a sin.

"It is all very well for the English to say that," replied the Persian. "But the fact is, they cannot tell lies and we can. It is entirely a matter of climate."

"In that case, Persians ought to speak the truth," said the Englishman. "One of the ancient Greek historians declared that Persians were remarkable for telling the truth."

"That is very true," said the native. "But who does not know that the climate of a country changes entirely in two thousand years?"

Humorous as the story is, I believe that it expresses an important truth. Dexter, in his book on "Weather Influences," has made a careful study of the influence of various meteorological conditions upon the conduct of schoolchildren, upon the occurrence of crime, and upon the number of errors made by bank clerks. His investigations were made in New York and Denver. His results confirm the

popular belief in the highly invigorating influence of clear, cool weather. They show, however, that although in damp, muggy weather people *feel* disagreeable and suppose themselves ready to do all sorts of evil things, as a matter of fact, they do not do them. The vital functions are depressed so far that there is no surplus energy to spend in doing anything very active, either good or bad. The only relief lies in talking and feeling cross. Dry weather, on the contrary, stimulates the vital processes, unless it be exceptionally warm, and creates a surplus of energy which finds expression in work or mischief, as the case may be. When, however, the dryness becomes extreme, people's nervous equilibrium is upset. The power to control emotional impulses of all kinds seems to be weakened. On very dry days in Denver, which are apt also to be windy days, the amount of crime among adults and of misconduct among school-children increases enormously. The nerves, according to Dexter, become unstrung by reason of the high state of electric or magnetic tension induced in the air by the dryness and wind. When the wind dies down and the air becomes more moist, the nerves return to their normal condition, but the human system has been through an experience which makes it more difficult to resist the next impulse toward whatever the feelings suggest. The tendency is toward nervousness and lack of self-control. Persons of strong physique and of steady nerves are influenced but little. In a region like that of Denver, it may be that the bracing effect of the climate in general offsets the evils of occasional extreme dryness. If Dexter's conclusions are correct, however, we should expect to find that people in extremely hot, dry countries, like Persia and

Chinese Turkestan, where parching winds abound, are nervous, emotional, and uncontrolled. As a matter of fact, they are not so nervous as might be expected; but they are certainly highly emotional, and very lacking in self-control. This, it may be, explains why the Persians are so prone to lying. The habit of telling the truth can be acquired only by long practice, by a continual exercise of the will in opposition to the suggestions of fear, greed, or the other feelings. So after all, perhaps it is "a matter of climate." And the obvious corollary is that during the last two thousand years a change in the climate of Persia may have contributed materially to a change in the character of the people, as Malcolm's story suggests.

Before we can properly estimate the influence of climatic changes upon history, it is necessary to investigate the types of change and the reasons for believing that climate varies uniformly over very wide areas.

Hitherto scientists have recognized two chief types of climatic change. The first is that of the Glacial Period, during which great fluctuations took place simultaneously, as it is believed, over the whole world, or at least throughout the northern hemisphere. The other is not so well known, as it was only discovered about 1890. Brückner, seconded by Clough and others, has shown good reason for believing that once in thirty-six years, on an average, the whole world passes through what may be called a climatic cycle. During a cycle there are two extremes, at one of which the climate of continental regions for a series of years is unusually cool and rainy, with a low barometric pressure and relatively frequent storms; while at the other it is comparatively warm and dry,

with high pressure and fewer storms. The changes are most extreme in mid-continental regions, decreasing toward the sea-coast, and actually being reversed in some maritime districts, such as eastern New England. The extremes of low temperature follow, and are apparently due to periods of maximum solar activity, as shown by the number of sun-spots and the rapidity with which they are formed. The times of largest rainfall depend on those of lowest temperature, which they follow at an interval of a few years. The other extreme is characterized by diminished solar activity followed by higher temperature and, a little later, by scarcity of rainfall. The cycles have been traced back by Clough to about 300 A. D., but the only data of any great degree of accuracy are those of the last century or more. During that time, the extremes, whether of heat or cold, have not shown any tendency to increase in intensity.

The Brückner cycles, as they are called, appear to differ from those of the Glacial Period in degree and regularity only. The effects upon glaciers, rivers, and lakes are of precisely the same nature; and the distribution of the two appears to be identical so far as the continents are concerned. Both are world-wide phenomena. The changes of climate of which we have found evidence in Central Asia partake of the nature of both the Brückner and the Glacial cycles, and lie between them in intensity. It seems reasonable to suppose that the three types of climatic change are of the same nature, are of the same solar origin, and are of equally wide distribution. Apparently, the climate of the earth is subject to pulsations of very diverse degrees of intensity and of varying length. The Glacial Period as a whole represents

the largest type of pulsation; upon it are superposed the great pulsations known as glacial epochs, each with a length measured probably in tens of thousands of years; their steady progress is in turn interrupted by smaller changes of climate, such as those of which we have found evidence during historic times in Central Asia; and finally, the climate of the world pulsates in cycles of thirty-six years, and even these are interrupted by seasonal changes and by storms. A curve representing the climate of the earth during the last million years would be almost infinitely complex, a sinuous line composed of large curves superposed upon larger, small upon large, and smaller upon small. It is conjectured that the smaller changes of climate are due to varying amounts of heat and other forms of energy received from the sun. It is probable, though it has not been demonstrated, that the larger are also due to the same cause.

Turning once more to our immediate subject, the changes of climate in Asia during the last two thousand years, we have seen that from analogy with the glacial and Brückner cycles we should expect them to be world-wide. Many facts point to the correctness of this view, though as yet the matter has not been critically studied outside of Asia. To begin where my own observations come to an end, Syria and northern Arabia, from three to five hundred miles south of Lake Gyoljuk, present phenomena almost identical with those of Central Asia. Mr. F. A. Norris, a member of the Princeton expedition to that region in 1904–05, states that a large number of ruins lie in the desert in locations where to-day there is no adequate water supply, and where it would be impossible to secure sufficient water with the sys-

tem of irrigation employed when the ruined cities were in their prime. Elsewhere the water which appears formerly to have supported oases is now saline. The ruins date from near the beginning of the Christian era. Not far removed from the Syrian ruins, Palestine is a well-known example of a land, once highly prosperous, which now suffers from aridity. Josephus, A. D. 75, describes Judea and Samaria as "moist enough for agriculture, and very fruitful. They have abundance of trees, and are full of autumn fruits, both wild and cultivated. They are not naturally watered by many rivers, but derive their chief moisture from rain, of which they have no want. By reason of their excellent grass, their cattle yield more milk than do those in other places; and as the greatest sign of excellence and abundance they are very full of people." A single description of this kind cannot be accepted as conclusive, but it is worth quoting because of its agreement with a large number of other data in regard to Palestine. One would hardly speak of Judea and Samaria to-day as countries which "have no want" of rain.

Farther to the south, the wandering of the tribes of Israel in large bands through the desert peninsula of Sinai, where small caravans now find but a scanty supply of water, presents the same sort of inconclusive, but not therefore insignificant, evidence of desiccation. As to Egypt, which shares the climatic conditions of Sinai, it has been concluded by Sayce, Unger, and others that the great diminution in the area of cultivation during the past three thousand years, the disappearance of certain plants like the nelumbo, — a kind of lotus, once a principal article of diet among the Egyptians, — and the presence of magnificent ruins in the now

uninhabitable desert far west of the Nile indicate a great change of climate. Fraas goes further, and says: "An intellectual activity like that of the times of the Greeks, when Alexandria was the centre of all the arts and sciences, a true world's university, with the richest library on earth; or as that which existed from the times of the Platonists up to the first centuries of the Christian era, when the greatest thinkers of the church — such as Origen, the Gnostic — developed their philosophical-religious systems, — such a movement of thought demands, as an absolute necessity, a different climate, and a moister air, than that now prevailing in Egypt."

Still farther to the west along the Mediterranean coast of Africa and in the Sahara desert many writers, on grounds that appear to be reasonable, have inferred that desiccation has taken place during historic times. Their observations, however, have generally, possibly always, lacked the quantitative element which alone can make them conclusive. The ruin which has overtaken northern Africa since the days of Carthage is matter of common knowledge. Apparently, the famous march of the Third Legion far into the deserts of Sahara was rendered possible by more favorable climatic conditions, such as those which enabled Alexander to penetrate the deserts of Central Asia.

We all remember how cold and swampy Europe seemed when we read Cæsar. We have been in the habit of assuming that the climate of his day was like that of the present, and that we remember the snow and the swamps because the conqueror of Gaul emphasized the difficulties which he met. Possibly, however, Cæsar was so great an artist that

he painted only the truth. So careful an author as Gibbon believes that the climate of Europe has changed since the days of the first Roman emperors.

In the first chapter of the "Decline and Fall of the Roman Empire" he says: —

"Some ingenious writers have suspected that Europe was much colder formerly than it is at present; and the most ancient descriptions of the climate of Germany tend exceedingly to confirm their theory. The general complaints of intense frost, and eternal winter, are perhaps little to be regarded, since we have no method of reducing to the accurate standard of the thermometer, the feelings or the expressions of an orator, born in the happier regions of Greece or Asia. But I shall select two remarkable circumstances of a less equivocal nature. 1. The great rivers which covered the Roman provinces, the Rhine and the Danube, were frequently frozen over, and capable of supporting the most enormous weights. The barbarians, who often chose that severe season for their inroads, transported without apprehension or danger, their numerous armies, their cavalry, and their heavy wagons, over a vast and solid bridge of ice. Modern ages have not presented an instance of a like phenomenon. 2. The reindeer, that useful animal, from which the savage of the north derives the best comforts of his dreary life, is of a constitution that supports and even requires the most intense cold. He is found on the rock of Spitzberg, within ten degrees of the pole; he seems to delight in the snows of Lapland and Siberia; but at present he cannot subsist, much less multiply, in any country to the south of the Baltic. In the time of Cæsar,

the reindeer, as well as the elk, and the wild bull, was a native of the Hercynian forest, which then over-shadowed a great part of Germany and Poland. . . .

"It is difficult to ascertain, and easy to exaggerate, the influence of the climate of ancient Germany over the minds and bodies of the natives. Many writers have supposed, and must have allowed, though, as it would seem, without any adequate proof, that the rigorous cold of the north was favorable to long life and generative vigour, that the women were more fruitful, and the human species more prolific, than in warmer and more temperate climes. We may assert with greater confidence, that the keen air of Germany formed the large and masculine limbs of the natives, who were, in general, of a more lofty stature than the people of the south, gave them a kind of strength better adapted to violent exertions than to patient labour, and inspired them with constitutional bravery, which is the result of nerves and spirits. The severity of a winter campaign, that chilled the courage of the Roman troops, was scarcely felt by these hardy children of the north, who in their turn were unable to resist the summer heats, and dissolved away in languor and sickness under the beams of an Italian sun."

Gibbon goes on to enlarge upon the low state of civilization among the ancient Germans, and upon the scarcity of the population. "In the most inclement weather," he says, "the hardy German was satisfied with a scanty garment made of the skin of some animal. The nations who dwelt toward the north, clothed themselves in furs, and the women manufactured for their own use a coarse kind of linen. The game of various sorts, with which the forests of

Germany were plentifully stocked, supplied its inhabitants with food and exercise. Their monstrous herds of cattle, less remarkable indeed for their beauty than for their utility, formed a principal object of their wealth. A small quantity of corn was the only produce exacted from the earth; the use of orchards or artificial meadows was unknown to the Germans." All this, it will readily be seen, is highly consistent with a climate much colder than that of to-day.

The cause assigned by Gibbon for the amelioration of the climate of Europe is the cutting away of forests and the opening of the land for cultivation. The same process has popularly been supposed to account for the undoubted change which has taken place in Palestine and northern Africa. Meteorologists, however, agree that although forests conserve rain after it has fallen, they have no appreciable effect upon its amount. Having examined the meteorological records for various regions where forests have been cut off, or where they have been allowed to renew themselves after having been removed, students find no evidence that the climate has been altered. Moreover, as we have seen in the Lop basin, desiccation has taken place over broad areas where the trees have by no means been cut off, but, on the contrary, have remained standing, and have died for lack of water. The chief influence of forests appears to be that they keep the soil in a more uniformly damp condition, which prevents floods and makes the rivers and springs of more uniform volume. They also serve as a protection, and keep the air within them from being suddenly heated or cooled, thus preventing rapid changes of temperature. As to the relation of forests to changes of climate, the fact seems

to be that in many arid regions forests have been cut off, and have not been able to replace themselves because of increasing desiccation due to other causes. In Europe, the forests have been cleared because the country has now become so warm that agriculture is profitable and a dense population can be supported. The climate of Europe seems to have gone through the same changes as that of Africa and Asia.

Before summing up the results which changes of climate may have had upon the history of the world as a whole, it will be profitable to inquire into the influence of the far milder changes of the Brückner cycles during the nineteenth century. If they prove to have been attended by important results, we can scarcely avoid the conclusion that greater changes must have produced greater results. The world-wide dry periods of the last century may roughly be said to embrace the years 1830–40, 1865–75, and 1887–97. During the first epoch the Lop basin suffered severely from drought. The villages of Dumuka, Ponak, and others were abandoned for lack of water; and new villages were founded higher upstream. Distress of the same sort prevailed in other places, and large numbers of people moved to new sites. Some went along the zone of vegetation, and far to the east founded the villages of Niya, Cherchen, and Charklik. The movements of this time are unquestionably due to climate, and it is fair to say that whatever of hardihood and experience, or of trouble and distress, came to the people as the direct result of their migrations, may be set down as a result, slight but genuine, of the action of geographic forces in forming character. The next two periods of deficient rainfall are characterized by rebellions among the Dungans and others, and by

attempts on their part to occupy better lands. I cannot state positively that prolonged drought was the cause of the rebellions, but it cannot fail to have contributed to the discontent which finally broke out in war.

In Persia, the three periods of deficient rainfall were marked by destructive famines, one of which, in the seventies, has been referred to in the chapter on that country. Farther west in Turkey, it is notable that these periods were times of especial commotion in that always troubled land. Between 1829 and 1833, all the Balkan states were in an uproar, there were rebellious risings in Asiatic Turkey, and war broke out with Egypt and Russia. During the later sixties and in 1874, fresh disturbances of the same sort once more led to war with Russia in 1877. Lastly, the middle of the nineties was characterized by some of the most atrocious massacres of all times, when Armenians were killed by scores of thousands. It is true that similar famines, insurrections, wars, and massacres have often occurred in the intermediate periods when in most places there was no special scarcity of rain, but they have almost invariably been less severe than those during the dry periods. The synchronism between the *greatest* disasters and the most pronounced lack of rainfall indicates a causal relation between the two, a relation which is unmistakable in the case of famines.

The connection of insurrections, wars, and massacres with deficiency of rain is less direct than that of famines, but no less real. It depends upon the state of irritability which prevails when scanty crops make it hard to sustain life and to pay taxes. Few people in more favored regions realize the distress which may arise from lack of the expected rain in

semi-arid lands. Wills has investigated the relation of rainfall to the product of wheat per acre in South Australia. He found that during the best seven years, when the average rainfall during the growing season was 18.5 inches, the average yield of wheat was 12.4 bushels. During the poorest years, when the rainfall averaged 13.5 inches, the yield was only 6.6 bushels. That is, when the amount of rain fell off one third, the wheat harvest fell off one half. During the four good years from 1897 to 1901, I lived in the city of Harput in Armenia on the upper Euphrates. The rainfall averaged twenty inches. Brückner's figures show that during the drier extremes in his cycle the precipitation of stations well in the interior of the continents is only half as great as during the other extreme. A falling off of one third in the rainfall of a place like Harput would therefore be moderate; but that, according to the Australian rule, would mean only half as much wheat as in good years. No one who knows the Turkish tax-collector can doubt the distress and the rancor against the government which this would occasion. I was the guest of a poor Kurd one day near Harput. When my escort, a Turkish soldier and tax-collector, left the room, my host picked up the Turk's whip, and holding it out to me said in Turkish:—

"Do you know what that is for?"

"For his horse," I answered.

"No," was the bitter answer. "It is for men, for us Kurds, when we can't pay our taxes."

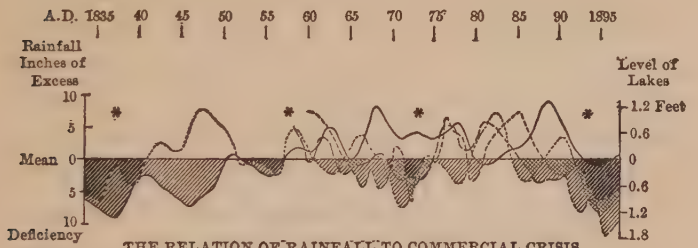
He went on to tell me a long story of how the soldiers came every year at harvest time, and when, because the crops were poor, the Kurds could not pay all that was de-

manded, beat them. In the case of Armenians, I have even known of women being beaten to extort taxes, and of men who were tied out of doors in a bitter winter wind while water was poured over them and they were allowed to freeze, for the same purpose. In such a land it is plain that deficiency of rainfall causes intense distress. One can scarcely blame the suffering peasants for being ready to rob and kill their more prosperous neighbors, for plotting against the government, or for hating the foreigners whom they are led to regard as the cause of their woes. If such results can follow from a short period of decreasing rainfall, what is to be expected from a period during which the decrease continues from generation to generation?

Turning now far away to America, we find that even this favored land has suffered during the same periods and for the same cause as the blighted countries of Asia. During the years when Chinese Turkestan had its migrations and rebellions, Persia its famines, and Turkey its revolts and massacres, the United States had its financial panics. Clayton has pointed out that during the nineteenth century, each of the great financial crises of the country has been associated with deficiency of rainfall. The accompanying diagram is better than words. The horizontal line denotes time; the curved lines show the amount of excess or deficiency of rainfall in various parts of the country; and the shading shows the times of deficiency. The proportion of the country which suffered from lack of rainfall is indicated by the depth of the shading, the black meaning that the whole received less than the normal amount. Poor crops generally mean high prices to the consumer, and unless the

farmer can raise much more than enough to supply his own needs, he has little to sell, and cannot pay his debts. Hence business of every kind suffers, and a financial panic ensues. Other things may be contributory factors, but the climatic factor seems to be the most fundamental.

As to the connection of panics with politics there can be little question. That of 1837 was a severe blow to Van Buren and his party, who in the next presidential election of 1840 were defeated by Harrison and the Whigs. Similarly, in



THE RELATION OF RAINFALL TO COMMERCIAL CRISIS
Drawn from Clayton's figures

* Financial Panic in the United States

Rainfall of New England — — — of Mississippi Valley

" " Ohio Valley ------ Level of Great Lakes

Depth of shading is proportional to the part of the inhabited area of the United States suffering from deficiency of Rainfall.

Note. — See Appendix on Level of the Great Lakes.

1874, as a result of the panic of the preceding year, the Republican majority of a hundred and seven in the House of Representatives was turned into a Democratic majority of seventy-four; and at the next presidential election it is often asserted that Tilden, the Democratic nominee, was the choice of the people, though he technically failed of election. Finally, the panic of 1893 was the chief cause of the rise of the Populist party, which practically passed away

when abundant rainfall and good crops brought on prosperity. In view of all this, Clayton concludes, with justice, I think, that even the small changes of climate incident to the Brückner cycle have been significant factors in American history. The idea that financial crises and political changes in the United States may be genetically connected with famines and revolts in Asia suggests a hitherto unsuspected unity of history. If the small changes of the Brückner cycle can produce such important results as those described in the preceding pages, it is clear that the far greater changes of which we have found evidence in Central Asia and elsewhere must have exercised a tremendous influence upon history.

In the dry regions of Chinese Turkestan, we have seen the effect of a change of climate from conditions of comparative aridity to great aridity; in Kashmir, we have seen the opposite effects produced by a change from conditions of extreme coolness and moisture to those of moderate coolness and moisture. The physical change in the two cases was of the same type, from a cooler, moister climate to one that is warmer and drier. The effect on human life, however, was utterly different. In places such as the Chira and Niya regions in Turkestan, the effect of increasing aridity was to drive away the nomads, and to greatly diminish the number of persons supported by agriculture and to reduce them to a somewhat lower stage of civilization. At Endereh, Yartungaz, Lulan, and elsewhere, the result was much more disastrous. Not only did the population decrease enormously, but the few people who remained were compelled to abandon agriculture and to adopt the life of semi-nomadic shepherds or fishermen. All arts decayed, and the people

degenerated to a very low stage of civilization. At Turfan, again, the population was permanently much reduced, and at one time, when a comparatively rapid increase of aridity was forcing the Mongols out of the mountains, the wandering nomads raided their neighbors in the villages of the plain so mercilessly as to drive away practically the whole population. Everywhere in arid regions we find evidence that desiccation has caused famines, depopulation, raids, wars, migrations, and the decay of civilization. In the moist region of Kashmir, on the contrary, higher temperature and diminished snowfall have made for progress. The nomads of ancient times have adopted the pursuit of agriculture; the number of people whom the region can support has increased many fold; and all manner of arts and crafts have been encouraged. The civilization of Kashmir is low compared to that of Europe, but it is far in advance of anything to which pastoral nomads attain.

Chinese Turkestan and Kashmir may be taken as typical of the effects of changes of climate upon the arid regions of the world, on the one hand, and upon the moister temperate regions, on the other. If our theories as to changes of climate and as to the influence of physical environment on human habits and character are correct, the history of Turkestan ought to be typical of that of the vast arid and semi-arid regions extending from Morocco on the west to Manchuria on the east; and the history of Kashmir ought to be typical of that of Europe and other cool, temperate regions. A glance at the history of the world as a whole shows that this conclusion accords with the facts. The nations of arid regions were highly civilized and powerful in the past: they

have fallen to-day. The nations of cool, moist regions were barbarous and weak in the past, but have risen to power to-day. And those such as Greece and Spain, and perhaps Italy, occupying regions between the two extremes, hold intermediate positions in civilization; they are behind the cool, moist countries of Switzerland, England, and Germany, they are ahead of the arid lands of Persia, Arabia, and Algeria.

It has often been said that civilization has advanced from east to west: it would be truer to say that it has advanced from south to north. In the Old World, the earliest countries to enjoy a high state of development were Egypt and Babylonia, situated about thirty degrees north of the equator. Next Persia rose to prominence, not much farther north, to be sure, but located at a higher elevation, where the climate was cooler. About the same time, Syria, Greece, and Carthage, lying between thirty-five and forty degrees of latitude, became dominant powers. The next step was roughly five degrees farther north, to Rome. After the fall of the Roman Empire, there was for a few centuries no nation worthy to be called a world power. Then, when the Dark Ages passed away, France, Austria, and the states of southern Germany, all of which lie between forty-five and fifty degrees from the equator, took up the traditions of Rome. Finally, during modern times, the northern nations of England, Prussia, and Russia have risen to places of power. In America, there has been a somewhat similar progress from south to north. First, at the beginning of the Christian era, Yucatan, in latitude twenty, became highly civilized; then in the Middle Ages, Mexico and the Aztecs, five degrees farther north; and to-day the United States and

southern Canada, with the centre of power between latitudes forty and forty-five.

In explanation of the manifest movement of civilization from south to north, it has been commonly said that, for some undefined reason, man's relation to climate has changed. As he has become more civilized, he has also become adapted to colder and moister climatic conditions. To put it more fairly, the civilized man of to-day, being supposedly of a more nervous organization than his predecessor of two or three thousand years ago, finds that his impulses toward activity and toward self-control are most perfectly balanced in a fairly moist and cool climate; whereas the pioneers of civilization found the most favorable conditions in a dry, warm climate. According to a further assumption necessitated by this view, man took the first great step toward civilization, that is, adopted the pursuit of agriculture, in arid regions where irrigation was necessary. It was an easy matter, so it is said, to lead a little water to a patch of seeded ground which otherwise would have been unproductive; far easier, indeed, than to clear and cultivate a similar patch which needed no artificial supply of water, but was sure to be full of a great variety of plants not wanted by the sower. To a certain extent these views are perhaps true, but if our theory of changes of climate is valid, they require profound modification.

According to the climatic hypothesis of history, as we may call it, mankind, since first the race gained the rudiments of civilization, has always made the most rapid progress under essentially the same climatic conditions. The conditions apparently are that the summers shall have a

sufficient degree of warmth and of rainfall to make agriculture easy and profitable, but not enough to be enervating; that the winters shall be cool enough to be bracing, but not deadening; and that the relation of summer and winter shall be such that with forethought every man can support himself and his family in comfort the year round, while without forethought he and his will suffer seriously. Comparatively clear, dry air and high barometric pressure appear to be subsidiary conditions favorable to human progress.

The evidence of climatic changes which we have found in the Old World seems to render it probable that these conditions have prevailed in each of the great countries of history at the time when it has risen to the highest degree of civilization and power. Therefore we may conclude that long-continuing changes of climate have been one of the controlling causes of the rise and fall of the great nations of the world. The Dark Ages, at first sight, do not seem to correspond to this conclusion. Climatic conditions, according to our hypothesis, were much like those of to-day. Accordingly, we should expect to find rapid progress of civilization in northern Europe. The discrepancy is easily explained. At the beginning of the Christian era, the vast plains of Central Asia appear to have supported untold hordes of nomads. When the plains began to grow rapidly drier, the inhabitants must have suffered sorely. According to Hahn, a rainfall of twenty inches a year in New South Wales makes it possible to keep over six hundred sheep on a square mile of land; with a rainfall of thirteen inches only about a hundred can be kept; and with ten inches only ten sheep. During the short space of a thirty-six-year cycle,

meteorological records show that the rainfall at certain Siberian stations near the centre of Asia may vary in the ratio of two and three tenths in the good years to one in the bad years. Therefore we can scarcely be exaggerating if we assume that during the great and relatively sudden desiccation in the early part of our era, the average rainfall decreased in the ratio of two to one. If it fell from thirteen inches to six or seven, the nomads would have been able to find pasture for only one sheep where formerly they found it for fifteen. If the rainfall fell from twenty inches to ten, the number of sheep would decrease from sixty to one. Manifestly, if such a change took place in the course of a few hundred years, most of the inhabitants would be obliged to migrate. As the nomads pressed outward from the drier central regions of Asia, we can imagine how they were obliged to fight with the neighboring tribes whom they tried to dispossess. The old inhabitants and the newcomers could not all live together; new migrations would be a necessity; and confusion would spread in every direction. Meanwhile, Europe, after its long period of blighting cold, was becoming warm and habitable, and the migrants pressed into it, horde after horde. No one tribe could stay long in its chosen abiding-place, for new bands of restless nomads pressed upon it. Rome fell before the wanderers. Nothing could stay their progress until the turn of the tide.

Perchance, though this is only vague conjecture, the legends of King Arthur and his knights bear a hint of what might have occurred all over Central Europe if it had not been for the influx of barbarians. England, in its remote corner of Europe, far from the dry plains of Asia, responded

at first to the influence of improved climatic conditions, until it, too, was reached by the migrating hordes of invaders. Meanwhile, in the most densely populated part of Arabia, another movement of the nations had begun, presumably because of the distress due to rapid desiccation. The Arab migrants carried with them the fanatical faith of Mohammed, and were by it inspired to remoter conquests. The migrants to Europe found there Christianity, and in time became its greatest exponents.

When the progress of desiccation was stayed in Asia, and the desert lands began to grow slightly more habitable, there was no further impulse impelling migration, and Europe was freed from further invasion. At last, at the beginning of the Middle Ages, she was free to develop in response to the favorable climatic conditions which had come upon her. Christianity and the civilization to which it gives name and form found a fruitful field of development, one which has continued to expand. Mohammedanism, too, was able to make progress for a time during the period of revival accompanying the expansion of the habitable areas of Persia, Syria, and other parts of Central Asia and north Africa. Under the Caliphs, Mohammedan civilization progressed more rapidly than did that of Christian Europe, but soon the climate ceased to become more favorable, and stagnation ensued, followed by retrogression, when a slight tendency toward desiccation again appeared.

To-day, the strongest nations of the world live where the climatic conditions are most propitious. Japan and north China in Asia; Russia, Austria, Germany, France, and England in Europe; and the United States and Canada in

America, all occupy regions where the climate is of the kind which we have defined as most favorable to the progress of mankind. Much as these nations differ in race, in ideals, and in type of civilization, they all agree in possessing a high degree of will-power and energy, and a capacity for making progress and for dominating other races. Throughout the course of history, similar conditions of climate seem to have prevailed wherever a nation has displayed these qualities. With every throb of the climatic pulse which we have felt in Central Asia, the centre of civilization has moved this way or that. Each throb has sent pain and decay to the lands whose day was done, life and vigor to those whose day was yet to be.

APPENDIX

STEIN identifies Pimo, or Pein, with ancient Kenan, the site referred to in chapter viii and now known as Uzun Tetti or Ulugh Mazar, north of Chira. This identification is doubtful, as appears from the following table of distances given by Hwen Tsiang, which is as accurate as could be expected from a casual traveler. I have reckoned the "li," the Chinese unit of distance, as equivalent to 0.26 of a mile.

NAMES OF PLACES	TRUE DISTANCE	DISTANCE ACCORDING TO HWEN TSIANG	
Khotan (Yutien) to Keriya (Pimo)	97 miles	330 li	86 miles
Keriya (Pimo) to Niya (Niyang)	64 "	200 "	52 "
Niya (Niyang) to Endereh (Tuholo)	94 "	400 "	104 "
Endereh (Tuholo) to Kotak Sheri? (Chemotona)	138? "	600 "	156 "
Kotak Sheri (Chemotona) to Lulan (Nafopo)	264? "	1000 "	260 "

If we use the value of the "li," 0.274 of a mile, given by Hedin, the distances from Khotan to Keriya and from Keriya to Niya, according to Hwen Tsiang, become 91 and 55 miles instead of 86 and 52 as given in the table, which is not far from the true distances, 97 and 64.

If, however, Pimo is identical with Kenan, as Stein thinks, the distances which Hwen Tsiang gives as 86 and 52 miles become respectively 60 and 89, which is evidently quite wrong.

Strong confirmation of the identification of Keriya with Pimo is found in a comparison of extracts from Marco Polo's and Hwen Tsiang's accounts of that city with passages from my note-book, written long before I had read the comments of the ancient travelers. Marco Polo says that the people of Pein, or Pima, as he also calls it, have the peculiar custom "that if a married man goes to a distance from home to be absent twenty days, his wife has a right, if she is so inclined, to take another husband; and the

men, on the same principle, marry wherever they happen to reside." The quotation from my notes runs as follows: "The women of the place are noted for their attractiveness and loose character. It is said that many men coming to Keriya for a short time become enamored of the women here, and remain permanently, taking new wives and abandoning their former wives and families."

Hwen Tsiang observed that thirty "li," seven or eight miles, west of Pimo, there is "a great desert marsh, upwards of several acres in extent, without any verdure whatever. The surface is reddish black." The natives explained to the pilgrim that it was the blood-stained site of a great battle fought many years before. Eighteen miles northwest of Keriya bazaar, or ten miles from the most westerly village of the oasis, I observed that "some areas which are flooded part of the year are of a deep rich red color, due to a small plant two or three inches high." I saw such vegetation nowhere else, and apparently it was an equally unusual sight to Hwen Tsiang.

In addition to these somewhat conclusive observations, Marco Polo says that jade is found in the river of Pimo, which is true of the Keriya, but not of the Chira, or of the other rivers near Kenan.

NOTE ON LEVEL OF THE GREAT LAKES

The Great Lakes fluctuate in level in response to changes in the amount of precipitation in their drainage basin. They may be regarded as an enormous rain-gauge. The fluctuation in the level of the lakes has been recorded for a longer time than has the rainfall of the basin as a whole. Hence they are used in preparing the diagram on page 377. This is legitimate, since the purpose is to show the *relative* amount of rain in different years, and not the actual amount in inches.

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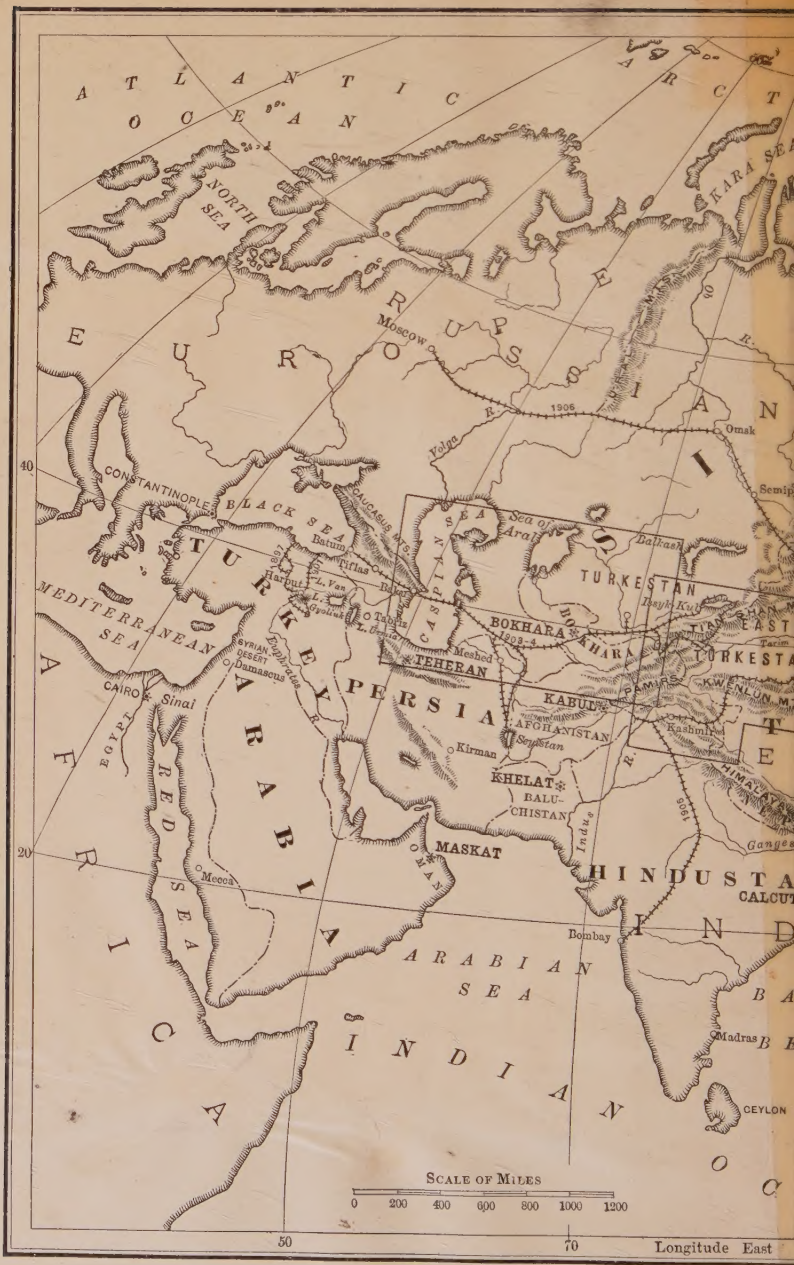

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